GENERAL LIBRARY
NOV 20 1918
UNIV. OF MICH.

Railway Mechanical Engineer

VOLUME 92, NUMBER 11 — ESTABLISHED IN 1832

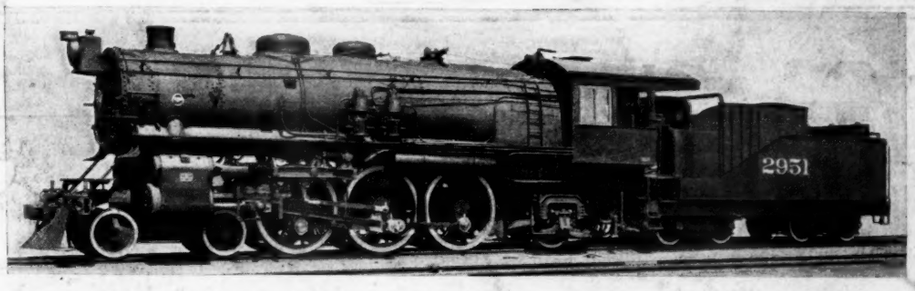
NEW YORK: WOOLWORTH BLDG. CHICAGO: Transportation Building — **NEW YORK—NOVEMBER, 1918—Chicago** — CLEVELAND: Citizens Building WASHINGTON: Home Life Bldg.

Entered as second-class matter at the post office at New York, N. Y., under the Act of March 3, 1879.
Published Monthly. Subscription price, United States, Canada and Mexico, $2.00 a year; foreign countries, $3.00 a year.

"HABIRLITE"

(Locomotive Headlight Wire)

AN insulated wire to meet the service conditions required for electric headlights on steam locomotives. This wire was developed by our engineering and chemical departments after careful investigation and overcomes the objections to rubber insulated and slow burning weatherproof wires.



"HABIRLITE" Solves The Problem

IT will not deteriorate and is not affected by heat, oil or moisture; less in diameter permitting the use of smaller conduits and fittings, and of indefinitely longer life than any other wire used for this service. Samples and full information on application.

Habirshaw Railway Signal Wire

Thirty years successful service

Habirshaw Power Cables

Rubber, Varnished Cambric and Paper Insulation
Sector and Concentric Cables

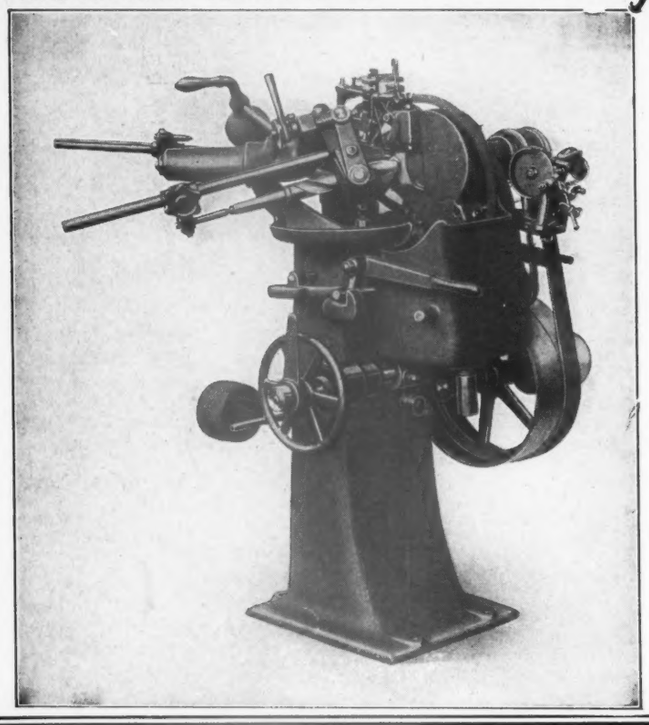
Manufactured only by

HABIRSHAW ELECTRIC CABLE CO., Inc.

10 East 43rd Street, New York City

William Sellers & Co., Incorp.

Philadelphia, Pa.



Labor Saving Machine Tools

Better Drilling—More Holes

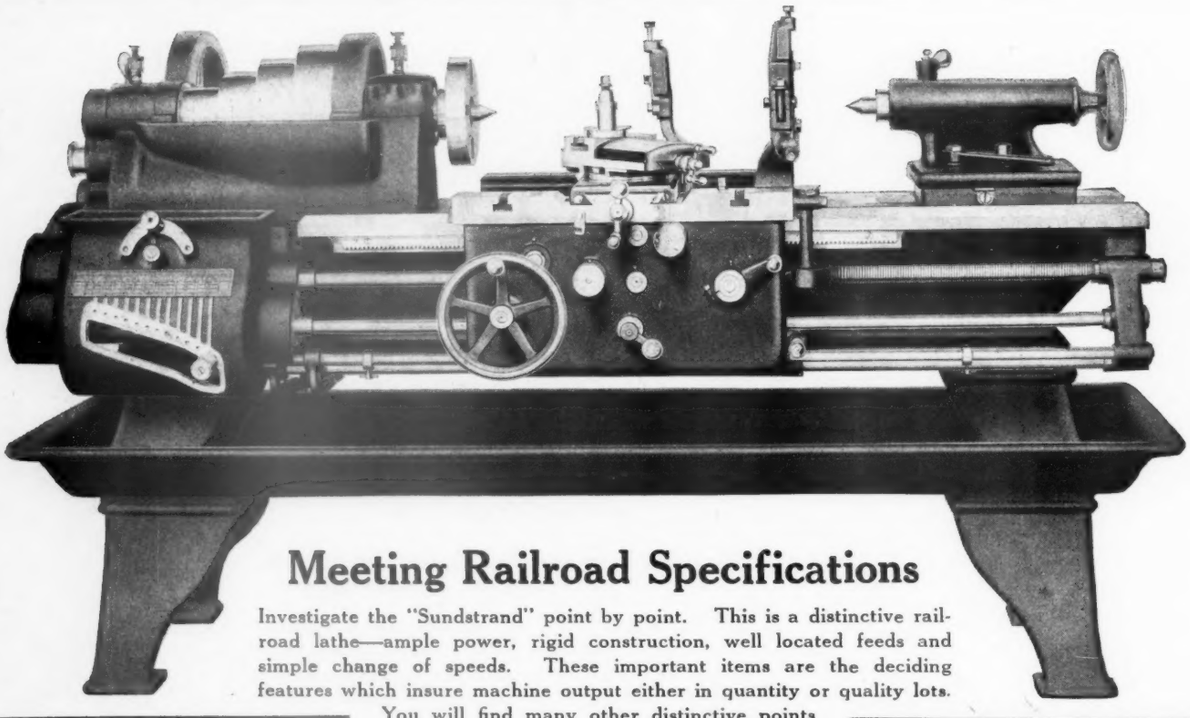
When the two lips of a drill are alike in shape they will take the same cuts, thus dividing the work equally and prolonging the life of the drill.

Improve your drills, increase their output, and reduce the cost of sharpening, by having them correctly ground and pointed by

The Sellers Drill Grinder

Drills sharpened by it cut faster, feed easier, and do more work, than when ground in any other way.

Tool Grinding Machines
Shafting—Injectors



Meeting Railroad Specifications

Investigate the "Sundstrand" point by point. This is a distinctive railroad lathe—ample power, rigid construction, well located feeds and simple change of speeds. These important items are the deciding features which insure machine output either in quantity or quality lots.

PRECISION

Whether it be a heavy cut or a light finishing "skim," you will find the finished piece true to form and size throughout—a feature that classes the "Sundstrand" lathe as a distinctive tool room lathe.

You will find many other distinctive points in this sturdy tool—may we send descriptive literature?

POWER

This sturdy lathe, with ample power to remove surplus stock, has many features which insure the handling of maximum output under the minimum effort—these features mark the "Sundstrand" as a lathe adaptable for every railroad requirement.

Rockford Tool Company

Rockford Ill., U. S. A.

Railway Mechanical Engineer

Volume 92 November, 1918 No. 11

CONTENTS

EDITORIALS:
Piecework Rates Being Revised ... 589
Journal Box Packing Situation ... 589
Standard Reinforcing for Ends of House Cars ... 590
Pyrometers in Spring Making ... 590
Don't Stop Saving Fuel ... 590
Supervision in the Mechanical Department ... 591
New Books ... 591

COMMUNICATIONS:
Journal Box Packing Situation ... 592
Time Lost in Slowdowns ... 592
Things Fixed ... 592

GENERAL:
Standard Six-Wheel Switcher ... 593
Locomotive Cab and Cab Fittings ... 596
Mechanical Department Supervision ... 597
Superheaters on Rotary Snow Plows ... 598
Conservation in Fuel Oil Boiler Plants ... 599
Virginian 2-10-10-2 Locomotives ... 600
Air Pump Strainer ... 604
Railroad Administration News ... 604
The Proper Location of Locomotive Cab Fittings ... 606
Data for Standard Locomotives ... 607

CAR DEPARTMENT:
Design of Seventy-Ton Coal Car with Tandem Hoppers ... 611
Limit of Cost for Freight Car Repairs ... 613
Bad Order Car Situation ... 614
Car Department of the Milwaukee ... 615
Standardizing Painting and Stenciling ... 620
Car Department Orders ... 620

SHOP PRACTICE:
Locomotive Superheater Maintenance ... 621
An Interpretation of the Order Increasing the Wages of Railroad Shop Employees ... 623
Forming Eyebolts on the Bulldozer ... 624
When the "Old Man" Showed His "Pep" ... 625
Hand Power Lathes for Rod Packing ... 627
The Difficulties of Welding Steel by the Oxy-Acetylene Welding Process ... 628
Grinding in Locomotive Shops ... 629

NEW DEVICES:
Cincinnati Acme Flat Turret Lathe ... 633
Gold Inside Connected Vapor Valve ... 634
Seamless Hollow Staybolt Iron ... 634

GENERAL NEWS:
Notes ... 635
Meetings and Conventions ... 636
Personal Mention ... 636
Supply Trade Notes ... 638
Catalogues ... 640

TO OUR SUBSCRIBERS

In the interests of the conservation of paper which the War Industries Board is so earnestly requesting, the Railway Mechanical Engineer will print at the end of the year only a sufficient number of indexes of the 1918 *volume to meet direct requests from its subscribers. It is requested, therefore, that those desiring indexes to so advise the New York office,* 2201 *Woolworth Building, on or before December* 20. *After that date the requisite number of indexes will be printed and mailed to those requesting them.*

Piecework Rates Being Revised

We are told on good authority that another revision of the wage scale is to be made to include a system of payment for pieceworkers. When supplement No. 4 was issued any consideration given the pieceworkers under General Order No. 27 was practically nullified. Since supplement No. 4 has gone into effect, however, it has been found that this has materially decreased the output and considerably increased the cost of doing the work. Various roads have estimated a loss in their output anywhere from 25 to 50 per cent. Human nature on the average is such that persons, unless they have an incentive, will do no more than they actually have to do and still hold their positions. This has been found sadly true in the car department of the railroads. The output per man is falling off and the cost of the work is being greatly increased. On one particular road we have in mind the men are performing about 25 per cent less work and getting from 60 to 70 per cent more money for the work they perform. If economical operation in the mechanical department is to be attained, and if the output is to be held up to the standard of the past, an equitable piecework rate must be established to provide the incentive for the men to work by the piece and not by straight day wages.

Journal Box Packing Situation

In our communications column is a letter from "Mechanical Engineer" asking for information regarding substitutes of wool waste for journal box packing. We welcome this opportunity of serving our readers, and particularly our correspondent, in this respect. Wool waste has become extremely scarce for journal box packing. It is being used successfully in the manufacture of blankets for our boys over seas and perhaps so successfully than even after the war it may be difficult to get the same grades of wool waste for packing as before, except at extremely high prices. The situation now is a serious one, and particularly to those that have had no experience with other than wool waste packing. Some roads are using 50 per cent cotton and 50 per cent wool, and there are other roads using all cotton. In addition to the type *C* packing mentioned by our correspondent the Railroad Administration's specifications contain two other grades, types *A* and *B*. Type *A* calls for 15 per cent vegetable fibre, 30 per cent shredded wool carpet, five per cent No. 1 domestic merino threads, 40 per cent cotton threads and 10 per cent shredded linsey carpet. The type *B* packing is made up of

35 per cent shredded wool carpet, 10 per cent No. 1 domestic merino threads, 20 per cent cotton threads, 25 per cent shredded linsey carpet and 10 per cent respun yarn.

It would be extremely interesting and of considerable service to the railroads if those who are successfully using packing that is available would send the *Railway Mechanical Engineer* a brief letter telling of the packing they are using and their experience with it. We invite your assistance.

Standard Reinforcing for Ends of House Cars

Practically every railroad in this country has taken some measures to make old freight cars serviceable under present conditions. This reinforcing has in most cases been confined to the draft members. The draft gear is undoubtedly the principal source of trouble but the old wooden house cars have at least one other point which must be strengthened if the reinforcing is to attain its object of keeping the car off the repair track. The part we refer to is the end. The long trains which are now hauled result in severe shocks in starting and stopping. Ends that were satisfactory when the motive power was light and the draft gear of a type that made careful train handling necessary are not able to meet the requirements of present day service. The foreman of the car department of a prominent road stated recently that a check of the repair bills showed that some cars had the ends knocked out three or four times in the course of a year. This no doubt represents an extreme case, but certainly it is false economy to equip a car with heavy draft members and leave unchanged a weak end construction that will require frequent repairs.

Half way measures for strengthening car ends are practically worthless. There is a growing tendency to apply heavy end lining in old wooden cars. While the added stiffness that is secured does assist in distributing the stresses it does not strengthen the posts to any appreciable extent and does not prevent their breaking or pulling out of the sockets. What is needed is a steel end or metal end post firmly fastened to the end sill and substantially braced at the top. Such construction will do much to eliminate a source of trouble second only in magnitude to short draft timbers. The Railroad Administration has specified the methods to be used in reinforcing draft rigging. Now it might be well to go a step farther and design an approved type of end reinforcing allowing sufficient latitude in the specifications to permit of its being applied on any repair track where the necessary facilities are available.

Pyrometers in Spring Making

The breakage of locomotive springs seems to be causing an unusual amount of trouble at the present time. There is a tendency on some roads to lay the failures to poor material or bad track without attempting to determine the cause. It is true that the spring steel furnished at this time may be of inferior quality, but it is improbable that this is the sole cause of the trouble. One road investigating the breakage of springs found that springs rebuilt in the company's shops failed much more quickly than springs received from the manufacturer, which of course indicated that the rebuilding was not being done properly.

There are no doubt many shops where an investigation of the methods of making springs would disclose numerous opportunities for improvement. The tempering of spring steel is an operation requiring great care. Most railroad spring plants are crude affairs and it is difficult to secure the exact degree of heat required for the quenching operation. Some of the furnaces used for tempering springs do not give an even heat and as a result the springs do not have a uniform hardness. The operation of drawing the temper requires even closer control of the heat than hardening. It is essential that the furnace give a uniform temperature and that the blacksmith should be able to determine when the leaves are heated to the proper point in order that the steel when annealed may have the required structure to give it strength and resiliency without brittleness.

As long as the judgment of the blacksmith is relied upon to determine when springs have reached the proper temperature the results are sure to vary. Lead or salt baths for heating the leaves prior to hardening and for drawing the temper are in use on some roads and have given excellent results. Pyrometers are used in both baths so the entire process can be regulated to make the springs uniform and of the exact degree of hardness required. There is one difficulty with this method that has not yet been overcome. The pyrometers require frequent checking to insure accuracy as no type has yet been found that can be depended on to maintain the original setting in this service. This is a minor matter, however, compared with the benefit derived from accurate heat treating. In one case it was found that the service life of locomotive springs was increased 50 per cent by the use of the pyrometer in tempering. The saving of work in the spring shop is a large item but there is a further economy due to the reduction in the labor incident to applying springs to replace those broken in service.

Don't Stop Saving Fuel

So much has been said about saving fuel in past years and the subject so vigorously agitated during the present year that it may seem to some to be an old story. It is an old story, but one which becomes increasingly important. At this particular time each day brings its demand for still greater economy in the use of fuel. It is one of the controlling elements in the life of the nation and particularly in the part this nation is to play in the war and the reconstruction after the war. If those men, if there are any and we hope there are none, who are sick and tired of being preached to on the subject of fuel economy, would again view the situation in its true perspective and consider that our industrials will need 18 per cent more coal than was used last year, our railroads seven per cent more, our steamships 30 per cent more, our gas and electric light plants 15 per cent more, and that the gross requirements for the whole nation will demand an increase of between 14 and 15 per cent of the output in 1917, they will take off their coats and put into practice the many things they have been taught will save fuel. As F. P. Roesch, fuel supervisor in the Northwestern region, stated in a paper before the Missabe Railway Club, it isn't the value of the fuel that we are trying to save—it is the fuel itself. Regardless of money it is impossible to increase the supply to meet the required needs. Economy is the only solution. We do not fully realize this on account of the fact that the government has fixed the price of coal with disregard to the supply and demand. There is hardly a person in the country but can contribute either by practicing economy themselves or urging others to do so. Everybody who handles any quantity of coal must be made to appreciate the situation. Everybody must do his best to conserve the power and heat produced by the coal. Don't waste lights, keep the office temperature down to a livable degree. Turn off the heat when the rooms get too warm. Stop the little leaks that are in the steam, air or water lines. Conserve the heat by insulating exposed surfaces. Revise the locomotive front end arrangement to suit the coal being burned in the firebox. Be sure that the arch is intact so that the fuel may be properly burned, and that the flues are clean, in order that the boiler may absorb all the heat possible. Do the many other things which you know will save fuel and don't ask yourself why somebody else doesn't do it, but do it yourself. Bring everybody about you to a full realization of the true fuel conditions. Make them appreciate how serious the situation is and set them a good example to follow.

Supervision in the Mechanical Department

Frank McManamy's paper before the New York Railroad Club on October 18 discloses a keen perception of the fundamentals of effective supervision and the vital part which supervision must play in the success with which the mechanical department shall meet the heavy burden of responsibility now placed upon it. The war has effected a general dislocation of the supply of both labor and material, requiring a more effective employment of the former and a smaller expenditure of the latter than has ever before been demanded of the maintenance organizations of our railroads. For an appreciable improvement in either respect we must look almost wholly to the supervision. It is unfortunate that a clearer appreciation of this fact has not sooner and more generally been manifested by the Railroad Administration.

The labor forces in the mechanical department have been dealt with liberally by any standard of comparison which may be chosen and of this, in principle, we hardly think there is a railroad man or a citizen who will not approve. The fact must be admitted, however, that the result has not been that increase in morale, that increase in the effort of the individual, so sorely needed in the present situation. Rather the opposite tendency has been observed. It is inconceivable that this is attributable to a lack of patriotism among railway mechanics. Railway men certainly average no lower, and probably no higher, in patriotism than any other equal group of citizens. But patriotism cannot be bought and patriotism alone can accomplish little without proper organization. Indeed, the present situation must be accounted for by a failure to observe some of the fundamental principles of successful organization rather than by questioning the motives of individuals, either in the ranks or in positions of responsibility.

A casting up of the situation in the light of the principles so clearly stated by Mr. McManamy may offer some constructive suggestions. These, in effect, are as follows:

1. Supervision to be effective must be adequate in quantity.
2. Supervision to be effective must be constant.
3. Supervision to be effective must be respected.
4. Supervision to be effective must be instructive.
5. Supervision to be effective must be courageous.

The first two principles have never been adequately observed by the railroads. There are few shops in which the number of foremen has been adequate, or in which these men have not been burdened with duties which properly do not belong to them. This is a condition inherited by the Railroad Administration, which offers the opportunity to render a real and permanent service to the mechanical department.

The action of the Railroad Administration leaves much to be desired on the third point. The respect accorded supervision depends upon many things—personality, authority and by no means least of all, the respect accorded by the management of the railroads to the supervising officers. In the wage increases and readjustments which have been effected, failure to give adequate consideration to the supervision has served to aggravate an already undesirable situation and undoubtedly has tended to lower the respect of the men for the supervising officers with whom they come directly in contact. The only standard by which the relative value of the men in the ranks and the supervising officers, charged with the full responsibility of securing output, may be estimated is earning capacity. The morale of no organization can be at its highest when relatively so little respect is accorded its supervising officers as is implied by the present relation between wages and salaries and by the large amount of public attention which has been given to the question of wages, with almost utter silence as to the claims of the supervision.

The instructive phase of supervision has never been given adequate attention by the railroads, a fact to which we have frequently called attention. One of the best means of fulfilling this requirement, especially with the dilution of labor skilled in the requirements of railroad work necessary at the present time, is the employment of instructors, whose duties are to supervise the methods employed in the performance of the various tasks in the shops.

The highest type of courage cannot be exercised by the minor supervisory officers when any of the normal relationships within the organization are out of joint. Courage, while primarily a personal quality, is seriously handicapped in its proper expression by a lack of esprit de corps.

There are two things which need to be done to secure adequate, constant, respected, instructive and courageous supervision: (1) Pay—pay what it is worth and pay for enough of it; (2) accord it the same encouragement and public recognition that has so lavishly been given to labor. These are as much demanded by justice as they are highly essential to the success of the motive power department organization.

NEW BOOKS

Modern Locomotive Valves and Valve Gears. By Charles L. McShane, 330 pages, illustrated, 5¼ in. by 7½ in., bound in cloth. Published by Griffin & Winters, New York Life building, Chicago. Price $2.50.

In order that this subject may be thoroughly understood by all persons seeking information regarding locomotive valves and valve gears, regardless of their previous training, this book includes a chapter covering the general definitions and technical terms used in connection with the subject. This is of particular advantage as it brings under one cover this important matter and a thorough discussion of the different types of valves. The action of the various types of valves is discussed very fully, which with numerous and particularly clear illustrations enable the reader to get a very clear conception of the operation of the various valve gears in general use, including the Walschaert with various modifications, the Baker valve gear, the Southern valve gear and the Young valve gear. Particularly full discussion is given to the Walschaert gear and in every case methods of setting these gears is given. The subject matter is written in a clear, understandable manner, every effort being made to keep away from the complex technicalities that are usually introduced in the discussion of the subject.

Eye Hazards in Industrial Occupations. By Gordon L. Berry, 145 pages, illustrated, 6 in. by 9 in., bound in cloth. Published by the National Committee for the Prevention of Blindness, 130 East Twenty-second street, New York. Price 50 cents.

In the United States there occur every year nearly 200,000 eye accidents, and about 15,000 people in this country are blind to-day as a result of injuries received in industrial occupations. The importance of the prevention of eye accidents to workers can be judged from the fact that they make up nearly 10 per cent of the total casualties reported. Practically all the major causes of injuries to eyes are present in railroad shops. These include machine operations, chipping and grinding operations, babbitting, sand blasting, riveting, using "mushroomed" tools, autogenous welding, spraying processes and using acids and chemicals. There is also danger of injury to the eyes from radiation from intense light and heat, from fumes, vapor and gases and from bursting gage glasses.

This book is the most complete compilation of material relating solely to the prevention of eye accidents, that has been published. Studies of the causes of accidents and the methods used to prevent them have been made in a large number of plants. Under each subject treated an account is given of the preventive measures which have been successfully used, and numerous illustrations help to make the descriptions clear.

COMMUNICATIONS

JOURNAL BOX PACKING SITUATION

Chicago, Ill.

To the Editor:

One of the greatest difficulties we are having to contend with in the car department at the present time is that of obtaining a suitable journal box packing. In the past our road has used long wool waste because of its resiliency and excellent capillary action, but this has been denied us and from lack of experience with other packing we are anxious to learn of a good substitute. At the present time we are using the *C* mixture specified in the United States Railroad Administration's specification No. R-94. This consists of 15 per cent vegetable fibre, 40 per cent cotton threads and 45 per cent wool threads. We have not had this in service long enough to determine exactly what results we will obtain from it. We have hesitated to use all cotton waste, although we understand that there are several roads which do. Believing that there are others of your readers who have had to contend with the same situation, your paper could undoubtedly be of valuable assistance to all the railroads if a thorough discussion of this subject were given in your columns.

Mechanical Engineer.

TIME LOST IN SLOWDOWNS

New York City.

To the Editor:

Having read with much interest the article on Time Lost in Slowdowns by Walter V. Turner, Eng. D., appearing in the September issue of the *Railway Mechanical Engineer,* I beg to offer a few remarks pertinent to the broad and general principles of the subject under discussion.

It is true that much time is lost by trains which in passing through populous communities are subject to local regulations governing the matter of speed. However, much delay is also caused by improper arrangement of schedules. Years ago a prominent terminal used a system which should have been perpetuated, as it was simple and eminently just. If a number of trains were due to leave in a short space of time, the most important one left first and the others followed in the order to which their standing entitled them. The big "limited" had a clear track and was out of the way before the next train came along, and thus an orderly procession was the result. Later on this arrangement was abolished and I have seen the most famous train in this country held up and brought to a full stop less than a mile from its starting point by a "penny-ante three-car local." Changes in this terminal have made observation of its operation difficult, and in any case its enlarged facilities may have improved matters. Be that as it may, there is still room for improvement in various parts of the country today and insignificant locals should not be permitted to "lay out" a road.

For a long time uninformed sections of the public imagined that fast trains were patronized exclusively by gilded "joy-riders." It is now being brought home to these people that the biggest men of the country, engaged in business of vital importance, find these trains a convenience and a necessity. Those who recall the "Exposition Flyer" of 1893 will remember that this 20-hour train between New York and Chicago was not patronized so much by visitors to the Fair as by bustling business men who recognized it as a public convenience and time saver.

Mr. Turner deserves a vote of thanks for directing attention to a subject of timely interest and practical value. Even those who are not sufficiently advanced to understand all of his figures will derive benefit and profit from a study of those aspects of the subject which they can comprehend, and will be encouraged thereby to familiarize themselves with the problems to which Mr. Turner refers.

Arthur Curran.

THINGS FIXED

Louisville, Ky.

To the Editor:

Concerning that word "Standard" about which we have had something to say.

We are now about to enter into a phase or cycle of standardization which needs to be keenly observed by every thoughtful mechanical man; laying aside all prejudice let us view the experiment broadly and with unbiased minds.

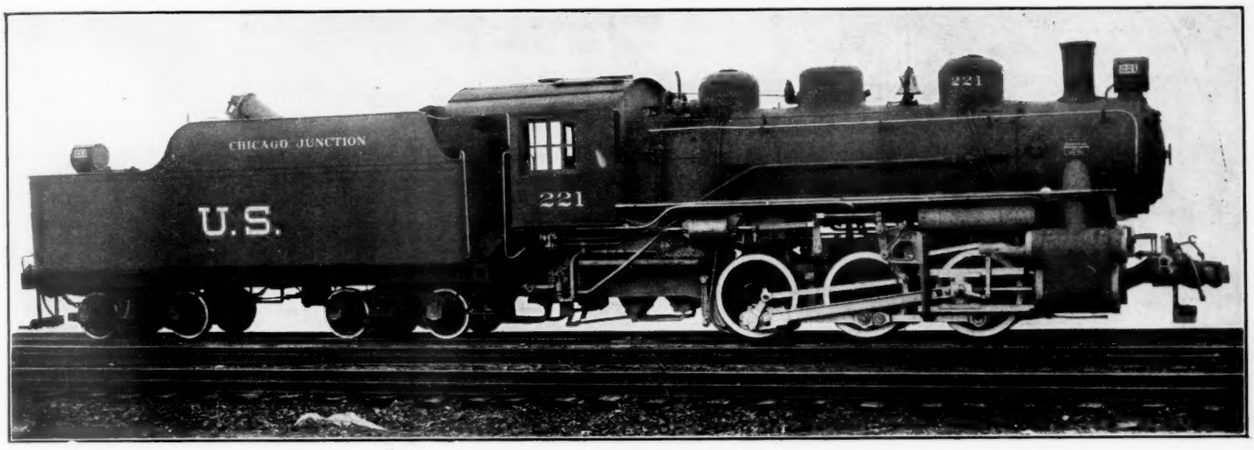
For the time being every pet idea must be relegated to the background and those things which we have harbored for the most of our lives, we are to forget for the present. Fall into line is the command and do with what has been allocated to our territory as if every detail were part and parcel of our own inventive genius. This is what our government has in effect requested and commanded and as good citizens and soldiers it is ours to obey to the letter and in the fullest spirit to which we assent. In order that nothing escape our attention, however, we note in passing that first of all we must make new patterns for these new locomotives, carry a new stock of gray iron and cast steel parts, a new line of fittings such as checks, water gages, steam valves, turrets, pops, gages, etc., etc., etc. We also note that our reamers, taps, milling cutters and dies are not suitable—nor have we jigs or templates suitable for renewals and repairs. All of which is merely by the way, inasmuch as we are preparing to lay in our stock accordingly so as to have everything in readiness for the next lot of new power.

Now the question is shall we accept these machines as they are without a comment or suggestion? Who is to guide the future design from the pitfalls to which every designer is a victim now and then? How long are these splendid engines to remain as they are? By whose authority are we to assume they will be the 1919 Model Mikado? Who is to follow up their daily performance and what is to be done if some detail is found to be impractical? Shall we keep to the design, literally renewing those parts which fail, just exactly as they were before they break, or shall we do as we have done heretofore and strengthen the weaknesses as they occur, keeping a memorandum of the various changes to be made in the next design in order to meet the conditions with which we are confronted on our various divisions. Common sense tells us that we are to face these questions and do the things as we have always done them. Locomotive designing is not yet finished; we must go on and and on to perfection, suggesting, experimenting, changing until the highest art is reached and reached again.

Who will then gainsay this plain simple reasoning. Does it not argue into the thinness of air the delusion of permanent design or THINGS FIXED.

Millard F. Cox, M.E.

Fourth Liberty Loan Returns.—It is estimated that the railroads have subscribed 75 per cent over the amount taken in the Third Liberty Loan. Complete returns have been received from three regions. In the Eastern region 12 out of 48 roads were 100 per cent, in the Central Western region 21 out of 42 roads were 100 per cent and in the Northwestern region 23 out of 38 roads were 100 per cent. In the Eastern region 90 per cent of the employees in the mechanical department subscribed and in the Northwestern region 99.33 per cent subscribed. The average subscription per subscriber was $102 in the Eastern region, $117.14 in the Central Western region and $112.12 in the Northwestern region.



STANDARD SIX-WHEEL SWITCHER

Fourth Design of the Government's Standard Locomotives to Be Built — Fourteen to Go to the Chicago Junction

DURING the month the fourth type of the government's standard locomotives was built by the American Locomotive Company at its Cooke Works. Fourteen of these locomotives are to be delivered to the Chicago Junction Railway and later twenty will go to the Pennsylvania Lines West and five to the Atlantic Coast Line. These locomotives weigh 165,000 lb. in working order; 55,000 lb. being carried on each axle, and they have 21-in. by 28-in. cylinders with 51-in. drivers. These engines have many details in common with the standard 0-8-0 locomotives which were described in the *Railway Mechanical Engineer* for October on page 543. They are also a great deal like the Six-wheel switchers built for the Chicago & North Western by the American Locomotive Company a few years ago, the cylinders, drivers and fireboxes being practically of the same dimensions and the boiler is of the same design with only about a difference of 100 sq. ft. in the total evaporating heating surface and 40 sq. ft. in the superheating surface. The Chicago & North Western engines have given excellent service in both transfer and switching work. These engines are used to transfer freight between the Fortieth avenue and Proviso yards in Chicago, a distance of about nine miles. They have handled 3,000 tons over grades of 0.92 per cent and 0.8 per cent.

The boiler of the standard 0-6-0 switcher is of the same general design as that of the Eight-wheel switcher. It was designed for a pressure of 200 lb. but has a working pressure of 190 lb. It is 66 in. in diameter, of the straight telescopic type, with 19/32-in. barrel sheets, 9/16-in. front tube sheet and ½-in. back tube sheet. There are 158 two-inch tubes and twenty-four 5½-in. flues, 15 ft. long over tube sheets. The size and length of the tubes are the same as those in the Eight-wheel switcher. The firebox is 72⅛ in. long by 66¼ in. wide. The door and crown sheets are ⅜ in. thick and the wrapper sheet and back head are 9/16 in. and ½ in. thick, respectively. The water legs are 5 in. wide at the throat and 4½ in. wide on the other three sides. There are three tubes for a Security brick arch and the O'Connor fire-door flange is used. There are 346 flexible, 58 hollow and 383 solid staybolts. The boiler is equipped with a 24-unit type *A* superheater having a heating surface of 442 sq. ft., which with an evaporating surface of 1,886 sq. ft. gives an equivalent heating surface of 2,536 sq. ft.

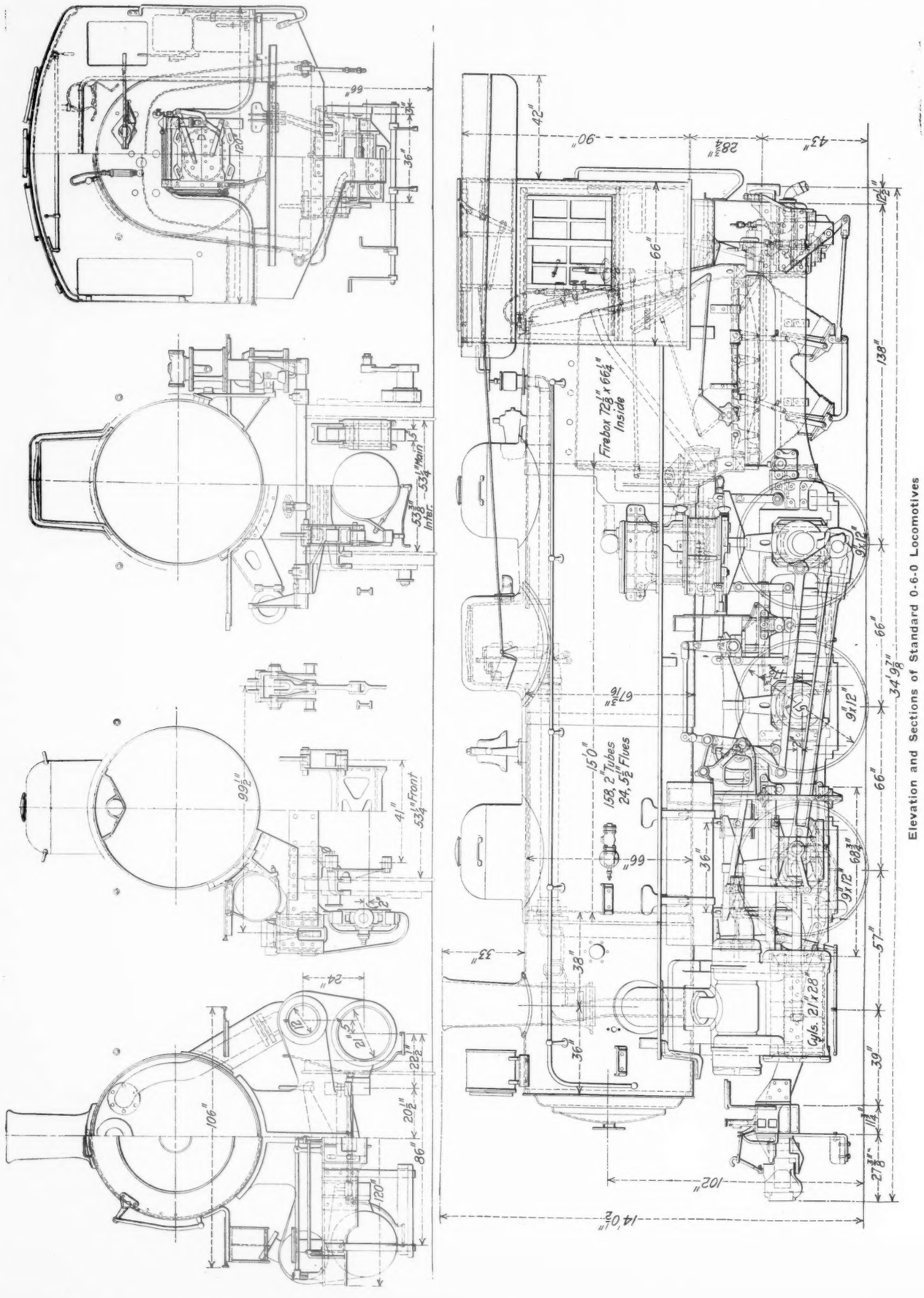
The general design of the frame for these engines is the same as for the 0-8-0 standard locomotives. These frames are 5 in. wide from the front to just back of the rear set of drivers, where a slab section 2 in. wide by 12 in. deep, increasing to 3 in. wide by 18 in. deep at the extreme end is provided. They are 5 in. deep over pedestals and 4⅛ in. deep at the smallest section of the upper rail. The lower rail is 3 in. deep. A heavier section is provided under the cylinders, the depth of the frame being increased to 7⅜ in. and to 9½ in. at the buffer beam. The pedestal binders have a minimum section of 3 in. by 5 in.

The side rods are of slab section, the front rod being 5 in. by 1½ in. and the back rod 4 in. by 1 5/16 in. These are coupled together with a 4-in. knuckle pin. The connecting rods are of channel section, being 6 in. deep with ⅞-in. flanges 3¼ in. wide,and ⅝-in. webs. A cast iron box type piston is used, having Hunt-Spiller bull and packing rings. The piston rod is 3¾ in. in diameter. The crosshead is of the alligator type, having Hunt-Spiller gun iron shoes. The steam distribution is controlled by the Baker valve gear, which in general is of a design similar to that used on the 0-8-0 switchers, many parts of which are duplicates. Both the Lewis and Mellin reverse gears will be used on locomotives in this order. The packing of both the valves and cylinders is of the United States Metallic Packing Company's design.

The piston valves are 10 in. in diameter and are fitted with bushings and packing and bull rings of Hunt-Spiller gun iron. The cylinder bushings are also made of the same material.

The tender is identical with that used with the 0-8-0 switchers, having a capacity of 8,000 gal. of water and 16 tons of coal. The tank has the Locomotive Stoker Company's type *D* coal pusher, Commonwealth cast steel underframe, and cast steel tender truck side frames to be furnished by the American Steel Foundries and the Buckeye Steel Castings Company. The tender wheels are cast iron, being 33 in. in diameter.

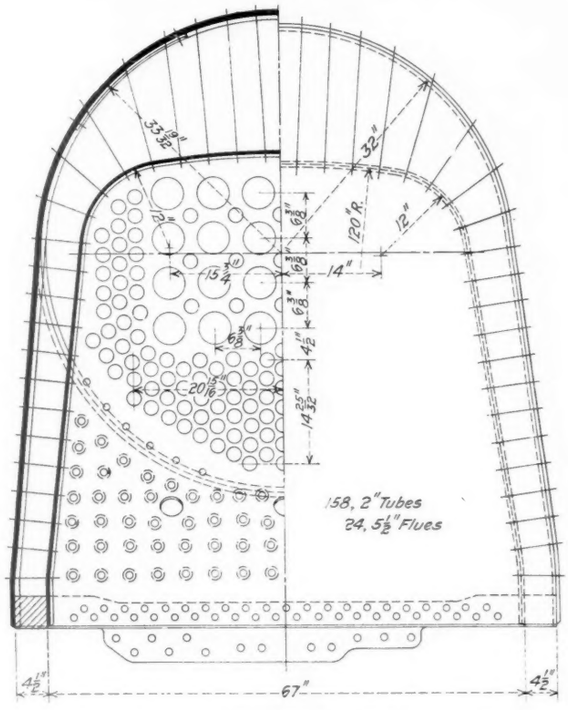
There are a large number of details on this locomotive that are common to the standard Eight-wheel switcher and a few common to all of the standard locomotives. Among the items common to both of the switchers may be mentioned driving axles, driving boxes, shoes and wedges, pedestal crosstie, grates, tube setting, coal pusher, many of the cab fixtures,



Elevation and Sections of Standard 0-6-0 Locomotives

bumper arrangement, bell details, reverse shaft yoke and bell crank. Such details as the dome cap, coupler, coupler drawhead, eccentric rod bearings, cylinder cocks and gage cocks are common to all of the standard locomotives.

These engines are to be equipped with the Shoemaker fire-

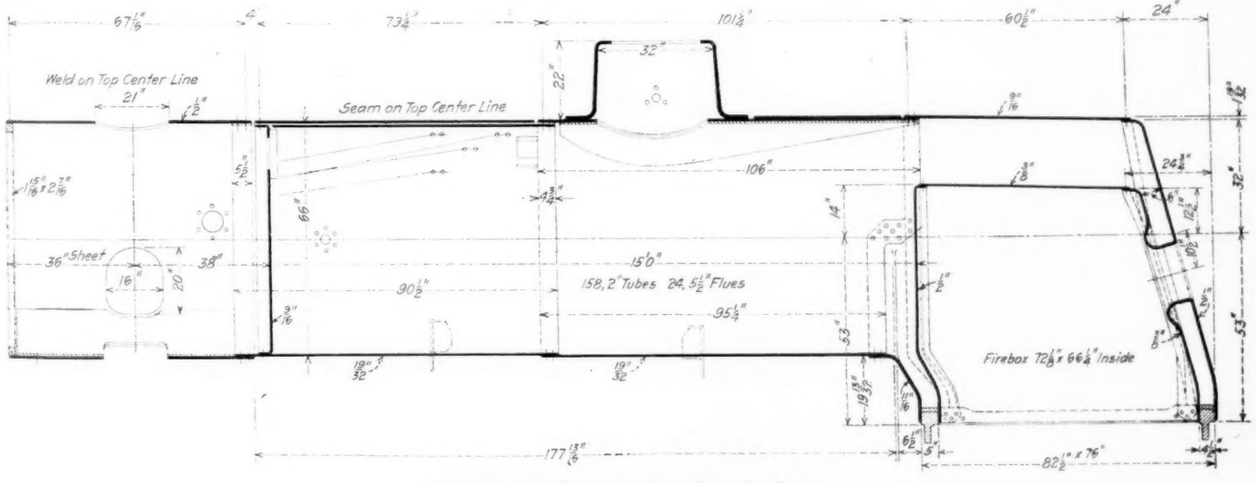


Sections Through Six-Wheel Switch Locomotive

door, Cole safety valve, Sargent safety three-face water gage, No. 11 non-lifting Nathan injector, Detroit three-feed lubricator, Pyle electric headlight, Westinghouse air brakes, Imperial type *B* uncoupling device, unit drawbar, Franklin flexible metallic joints, Ashcroft steam gages, Chicago Railway Equipment Company brake beams, Woods tender side bearings, Westinghouse type *D*-3 draft gear, Hancock sprinkler, Chambers throttle and United States Metallic Packing Company pneumatic sanders.

The following table contains the principal data and dimensions of these engines as compared with those built for the Chicago & North Western by the American Locomotive Company a few years ago:

	U. S. R. A. Standard	Chicago & North Western
General Data		
Gage	4 ft. 8½ in.	4 ft. 8½ in.
Service	Switching	Transfer
Fuel	Bit. coal	Bit. coal
Tractive effort	39,100 lb.	37,000 lb.
Weight in working order	165,000 lb.	171,000 lb.
Weight on drivers	165,000 lb.	171,000 lb.
Weight of engine and tender in working order	309,000 lb.	298,000 lb.
Wheel base, driving	11 ft.	11 ft. 6 in.
Wheel base, total	11 ft.	11 ft. 6 in.
Wheel base, engine and tender	49 ft. 3½ in.	47 ft. 6¼ in.
Ratios		
Weight on drivers ÷ tractive effort	4.22	4.62
Total weight ÷ tractive effort	4.22	4.62
Tractive effort × diam. drivers ÷ equivalent heating surface*	782	732
Equivalent heating surface* ÷ grate area	77.3	78.9
Firebox heating surface ÷ equivalent heating surface,* per cent	5.41	5.89
Weight on drivers ÷ equivalent heating surface*	64.7	66.28
Total weight ÷ equivalent heating surface*	64.7	66.28
Volume both cylinders	11.22 cu. ft.	11.22 cu. ft.
Equivalent heating surface* ÷ vol. cylinders	226.5	229.8
Grate area ÷ vol. cylinders	2.94	2.96
Cylinders		
Kind	Simple	Simple
Diameter and stroke	21 in. by 28 in.	21 in. by 28 in.
Valves		
Kind	Piston	Piston
Diameter	10 in.	12 in.
Greatest travel	6 in.	6½ in.
Outside lap	⅞ in.	1 in.
Inside clearance	0 in.	0 in.
Lead in full gear	⅛ in.	⅛ in.
Wheels		
Driving, diameter over tires	51 in.	51 in.
Driving, thickness of tires	3½ in.	3½ in.
Driving journals, main, diameter and length	9 in. by 12 in.	9½ in. by 12 in.
Driving journals, others, diameter and length	9 in. by 12 in.	9½ in. by 12 in.
Boiler		
Style	Straight	Straight
Working pressure	190 lb. per sq. in.	180 lb. per sq. in.
Outside diameter of first ring	66 in.	66 in.
Firebox, length and width	72⅛ in. by 66¼ in.	72⅛ in. by 65¼ in.
Firebox plates, thickness	½ in. and ⅜ in.	⅜ in.
Tubes, number and outside diameter	158—2 in.	160—2 in.
Flues, number and outside diameter	24—5½ in.	22—5¾ in.
Tubes and flues, length	15 ft.	16 ft.
Heating surface, tubes	1,233 sq. ft.	1,333 sq. ft.
Heating surface, flues	515 sq. ft.	492 sq. ft.
Heating surface, firebox	138 sq. ft.	152 sq. ft.
Heating surface, total	1,886 sq. ft.	1,977 sq. ft.
Superheater heating surface	442 sq. ft.	402 sq. ft.
Equivalent heating surface*	2,549 sq. ft.	2,580 sq. ft.
Grate area	33 sq. ft.	32.7 sq. ft.
Smokestack, height above rail	14 ft. ½ in.	14 ft. 5¾ in.
Center of boiler above rail	102 in.	103 in.



Boiler for the Standard Six-Wheel Switcher

Tender		
Tank	Water bottom	Water bottom
Frame	Commonwealth	Cast steel
Weight	144,000 lb.	127,000 lb.
Wheels, diameter	33 in.	33 in.
Journals, diameter and length	6 in. by 11 in.	5 in. by 9 in.
Water capacity	8,000 gal.	6,500 gal.
Coal capacity	16 tons	10 tons

*Equivalent heating surface = total evaporative heating surface + 1.5 times the superheating surface.

LOCOMOTIVE CAB AND CAB FITTINGS*

The many types of engines make a universal design of cab hardly feasible, but it is felt that the following suggestions could be adapted to any design of locomotive cab:

Body of Cab.—The overhang of a cab should be of dimensions such as will insure protection from the elements to the fireman. This really necessitates its extension to a point approximately over the coal doors on the tender.

It is the opinion of the committee that the front windows of the cab should be as close as consistent to the engine crews' usual and proper position in the cab. This is to provide a broader view for the engine crew.

The side windows provided for locomotive cabs are as a general rule of the sliding type, and we believe that a sash should be constructed in such a manner as to provide for small panes of glass, for the reason that the portion of frame between window panes forms a brace lessening the liability of breakage, and in case of breakage it reduces the cost of replacing, and lessens the opening while in service.

Ventilators should be provided and so constructed as to exclude cinders.

Gutters on sides of cab should be located immediately over the windows in such a way as to afford all of the protection possible to the engine crew. The opinion of the engineman is that it should be immediately over the cab window.

Cab Fittings.—Receptacles should be provided for signal appliances, such as lanterns, fusees, flags, torpedoes, etc. Torches, oil cans, hand tools, shaker bars, broom and other portable cab equipment should have convenient receptacles or hangers provided so that they may readily be located by the engine crews.

Boiler Appurtenances.—The steam manifold has been given various locations. Some are inside of the cab directly on top of the boiler, and where two are used they are usually located in the cab on the sides of the boiler near the top. Those located outside of the cab are just forward of the cab on top of the boiler and are provided with rods that extend through the front of cab for the purpose of operating the steam valves on the steam turret. This last mentioned arrangement, that is outside the cab, has numerous advantages over those located inside. It produces a cooler cab in warm weather and a drier cab in the cold season; it lessens the number of steam pipes in the cab and correspondingly decreases in number the pipe holes in cab that are generally hard to seal and keep tight against severe weather.

It is believed that better provisions could be made for the securing of the injector to the boiler. It is suggested that it be provided with a bolting flange similar in a way to the bolting flange on an air pump with a bed plate on the boiler. In cases where injectors are located outside of the cabs substantial rods equipped with durable joints and suitable brackets that will keep the rod from turning and thereby change the capacity at times when it should remain constant, should be provided. The operating handles should be located conveniently within reach of the engine crew.

There is no question but that the "Bull's Eye" type of lubricators is most desirable, but the manner in which they are secured deserves greater attention.

Throttle and Reverse Lever.—It is desirable to have the throttle lever so located that it can be readily handled by the engineer and at the same time have his head outside of the window to observe signals from either front or rear.

Where a power reverse gear is used an indicator should be provided to indicate the position of the valve gear. When air reverse gear is used, the steam connection globe valve should be located within handy reach of the engineman in the cab, so that the steam pressure may be readily turned on in case of an air failure.

Brake Valves.—Automatic and independent air brake valves in cabs should be located in a manner to provide ample clearance with the handles in any position and so they may be easily operated from the engineman's usual position.

The report was signed by: J. H. DeSalis, chairman; W. H. Corbett, W. W. Shelton, H. H. Schulte and H. F. Henson.

*Abstract of a committee report presented at the 1918 convention of the Traveling Engineers' Association.

DISCUSSION ON CAB FITTINGS

John McManamy, supervisor of equipment, U. S. R. A., outlined the arrangement of the cabs of the government standard locomotives in which many of the suggestions made in the paper had been carried out. He spoke particularly of the desirability of having all valves and steam pipes outside the cab. The government standard locomotives are equipped with two water glasses as a special safety provision. Care has been taken to prevent interference between the devices in the cab and all handles have a clearance of 3½ in. from adjacent parts in every position.

F. P. Roesch, fuel supervisor, U. S. R. A., commented on the inconvenient arrangement of valves found on many locomotives. Oftentimes the valves can only be packed from the top of the cab and consequently there is an excessive leakage of steam. Mr. Roesch advocated taking out of the cab everything that could conveniently be located elsewhere. He suggested that the steam manifold might well be set against the back of the dome where there was no chance of it being damaged in case of collisions or accidents.

G. A. Kell, Grand Trunk, told of the complaints received from enginemen when the vestibule cabs were first installed. The men objected to them on the grounds that they were noisy, cold and dirty. By greasing the buffers the noise was largely reduced and a dust-board on the roof assisted in keeping out the dirt. In order to keep the cab warm about 10 in. of lagging was removed from the boiler just above the floor of the cab.

A. N. Wilsie, C. B. & Q., spoke of the importance of locating the feed valve in a convenient position in the cab and also mentioned the good results that had been secured by placing a contrifugal dirt collector in the delivery pipe near the main reservoir.

L. D. Gillett, Dominion Railway Commission of Canada, endorsed the vestibule type of cab as the best thing for protecting the enginemen and insuring comfort under all weather conditions. He stated that the vestibule cab if properly designed and maintained was comfortable both in the hot and cold weather.

J. C. Petty, N. C. & St. L., stated that it was found necessary to remove the vestibule cabs from the Russian locomotives operated in this country. He stated that the failure of this type of cab might have been due to the fact that they were built of sheet steel but were not lined.

F. Zwight, Nor. Pac., spoke of the failure of the clear vision cab window in cold climates. After the windows were installed, as required by law, so many objections were received from the enginemen that it was found necessary to return to the use of a double glass with a dead air space between. Several members spoke of the desirability of shortening the cab to bring the front window nearer to the enginemen and give them a broader angle of vision.

J. H. DeSalis, N. Y. C., in closing the paper stated that while there were many changes in cabs which would add to the comfort of the enginemen, it was impossible to bring these changes about quickly in the present circumstances.

MECHANICAL DEPARTMENT SUPERVISION*

Better Supervision and More of It Is Needed to Keep Up Shop Output Because of Dilution of Labor

BY FRANK McMANAMY,
Assistant Director, Division of Operation, United States Railroad Administration

THE importance or in fact the necessity of efficiency in the railroad organization cannot be overestimated and, as stated by the director general in his report to the President, the efficiency of the railroads depends entirely upon the supply and condition of the motive power and the efficiency with which it is operated. The important question, therefore, is to get the locomotives in shape to perform efficient service and maintain them in that condition. At the present time the big factor in this is the question of supervision of shops and shop work.

Reports show that there are employed in the mechanical department of the railroads under Federal control, 393,000 persons, of whom 255,000 are in the locomotive department and 138,000 in the car department. To insure efficient and economical handling of this labor and material, organization is required and the prime factor in any organization is supervision. Railroad forces, and particularly maintenance of equipment forces, have been subjected to heavy drain because of the war and this has resulted in dilution of the quality of labor. Because of this dilution supervision both in kind and in quantity, becomes even more important than heretofore. It is to-day the *big* problem in railroad operation.

Supervision to be effective must be adequate in quantity, therefore, the number of workmen under one officer must be such that the officer is in constant touch with his force. Persons who have studied military and industrial organizations state that one man can properly supervise not to exceed from 25 to 35 men, a figure much below that which is often used in railroad work which has been known to extend to nearly 100 men. The statements as to the number of men who can be properly supervised by one officer are based on studies made when conditions were normal. In view of the necessity for the intensive use of labor and material to-day, because of the demand for both, the figures stated are, I believe, too high.

Supervision to be effective must be constant. The withdrawal of the foreman or supervising officer from his duties many times each day to answer summons from those in authority, the preparation of reports and routine office work which could be done in much less time by persons with clerical experience, the daily attendance to staff meetings which necessitates absence from usual duties for periods ranging from 30 minutes to two hours, are not conducive to efficient supervision.

Many supervisory positions have been permitted to become supervisory positions in name only. We find superintendents of shops, master mechanics, general foremen, roundhouse foremen and even men in positions of lesser responsibility, required to devote so much time to office work, to personally transmitting reports to superiors and to other work of like character, that they can devote little or no time to the direction of the active work, and by active work I mean the actual expenditure of the labor and material under their control.

Supervision to be effective must be respected, and this applies to those of higher as well as lower rank. The possession of proper title to indicate the character of services rendered which will command respect from those under his jurisdiction and consideration from those in other departments with whom he comes in contact, is a necessary advantage which should be given each supervising officer.

Active competition for supervisory positions should be encouraged by making such positions as attractive as possible and if this is done, it will result in securing the best material available, which is highly essential if the output in both grade and in quantity is to be kept up to the standard.

Supervision to be effective must be instructive. Some one has said that the principal reason for not getting the result we anticipated was because we failed to explain just what was wanted—a lack of understanding. To this cause may be laid many failures both of men and of plans. It is necessary, therefore, that instructions be complete, that they be concise, that they be understandable, and that—above all, they be workable.

The issuance of orders is the easiest thing in the world, but to issue a large number of orders is to insure their being disregarded. Voluminous instructions therefore should be carefully avoided. If this is done and the instructions issued are brief and are to the point, better observance may be expected; instructions alone, no matter how carefully prepared, are of little value without a proper follow-up or checking system to see that the instructions are observed and the work up to the required standard.

Supervision to be effective must be courageous. The quality of production comes from the top downward. We get from the average workman as good a job as we accept, no better. Supervision must maintain the accepted standards and this requires, in many cases, real courage, but it is necessary, and the supervising officer is the only means whereby this can be accomplished. With the conditions now existing the maintenance of high standards is necessary to the morale of the forces and to the preservation of proper discipline.

There are approximately 20,000 more employees in the locomotive department to-day than there were a year ago and approximately 8,000 more in the car department than for this date last year. Added to this we are working more hours, many more hours, per week than we did a year ago. With the increase in force and the increase in man hours, we are not in all cases receiving the returns we should; I attribute this largely to inefficient supervision.

I have endeavored to point out some of the essential requirements of effective supervision but it must be more—it must be responsible, as authority and responsibility go hand in hand. We cannot separate them and if we confer adequate authority on an officer he must have sufficient confidence in his own ability and judgment to do the work required and assume the responsibility for it.

Since the government has assumed control of the railroads supervising officers have often made the statement that they did not know just what authority they had and in many instances when matters which have always been handled by certain officials have been put up to them their reply has been "I do not know whether I can handle this without instructions from Washington," and this has been given as an excuse for failure of almost all kinds.

Paragraph 1 of General Order No. 1, issued by the director general on December 29, 1917, reads as follows:

> All officers, agents and employees of such transportation systems may continue in the performance of their present regular duties, reporting to the same officers as heretofore and on the same terms of employment.

This in the absence of subsequent orders to the contrary, seems to me effectually to dispose of any doubt as to the

*Abstract of a paper presented before the New York Railroad Club.

authority of supervising officers and leaves the question of failure to properly supervise the work squarely up to the officer involved. What is wanted by the Railroad Administration is that each railroad officer or employee who remains in the service, who continues to perform the usual duties assigned to him will if possible do a little more work than he ever did before and do it a little better.

There can be no question as to the authority of railroad officers under government control to perform all of their usual duties and there has been no lack of support from the Railroad Administration when those duties were properly and diligently performed.

A discussion of the question of supervision would not be complete without considering co-operation in connection therewith, because I believe the real test of the supervising officer is his ability to obtain the co-operation of the men working under his direction. The extent to which the supervising officer can get his force to work together for a common object depends almost entirely upon his attitude toward the men and his interest in the work that is being done. The supervising officer who considers that his full duty has been performed when he has issued instructions covering the work to be done is not going to secure any great amount of co-operation. He must show the employee that he has a personal interest not only in the work but in the workman. They must know that in addition to passing out the work slips he is going to follow them to see that the work is promptly done and in a workmanlike manner. He should also encourage workmen by seeing that both material and tools are supplied to mechanics so that they may keep their machines in operation, for there is no one thing that goes further to discourage a good mechanic and curtail the output than to require him to shut down his machine while locating materials which should have been delivered by a laborer or to secure tools which a tool messenger should have delivered.

There is nothing that will keep a force of men at their best quite so well as the knowledge that the supervising officer is on the job, inspecting their work, both as to quality and quantity, and that good work will be noted and the workman given due credit, as surely as work that is not up to the standard will be corrected.

In addition to co-operation between employees and supervising officers we must also have co-operation between different departments if we are to get results out of our locomotive shops. The work must be co-ordinated so that time lost by one department in waiting for another is reduced to a minimum. To bring this about it is usually necessary for certain employees in one department to work overtime or to make an extra effort so that some one else is not waiting for the job they are doing and this is one of the times when co-operation between supervising officers and employees is of direct benefit because without it there is frequently objection on the part of the employees to work the necessary overtime to help some one else.

Absolute fairness in handling this is also necessary because if the employee loses confidence in the supervising officer's fairness in matters of this kind, objection to the overtime worked will usually result.

Co-operation between shops and roundhouses is extremely important and roundhouse jobs should be given preference and promptly handled, because in this way many locomotive hours may be saved.

Increased shop output due to closer co-operation and better supervision over the maintenance of power will avail us little without co-operation between the transportation department and the mechanical department with respect to the use of power.

The railroads were taken over by the government not because it desired to go into the railroad business but because under the conditions which existed at that time increased efficiency was absolutely necessary. The efficiency with which the railroads had been operated prior to that time was not the question at issue because, however great that may have been, still greater efficiency was required.

It has been the general impression among the people, if we are to judge by the remarks made when the subject was discussed, that government operation of railroads would simply establish a big political machine and that efficient railroad men would be displaced to make room for politicians and for that reason the present organizations would be destroyed and replaced by inefficient ones. Nothing could be farther from the truth so far as the present Railroad Administration is concerned. Order No. 1 of the director general has made it clear that under government control of railroads there would be no disposition to replace competent, experienced railroad officers or employees. In fact, I can say emphatically that no railroad officer or employee who is efficient and diligent in the performance of his work was ever so secure in his position as he is at the present time.

The question before us at the present time is not as to whether government control or government ownership of railroads is a good thing or a bad thing—that will be settled by the people after the war.

The question before the railroad officers and employees to-day is solely one of operating efficiency and still greater efficiency in order to meet the demands placed upon them. The operation of the railroads of the country as a unit during the war is the most severe test that has ever been placed upon the railroad men of the country. The operation of railroads is not only the Railroad Administration's job, it is also the railroad man's job. It is not the Railroad Administration's reputation that is at stake, it is the reputation of the railroad man that is at stake; this brings the issue down to each individual, which is just where it should be.

The question before us is not what is the other fellow doing nor what did we do last year, but what am I doing now to help increase the efficiency of railroad operation. This question will be best answered by the record of achievement.

The railroad men of the country have furnished their full quota for the front in all branches of service; they have gone over the top in the Liberty Loans; they have repaired more locomotives and pulled more tons of freight than ever before and I am sure that the record of operating efficiency will be equally as good during the time the railroads are under the control of the administration.

SUPERHEATERS ON ROTARY SNOW PLOWS

The use of highly superheated steam in rotary snow plows provides a substantial increase in the power of the plow and also reduces the fuel and water consumption, so that the danger of running out of fuel and water at some point where an additional supply cannot readily be obtained is considerably lessened. In a recent example of the application of superheaters to a rotary snow plow on a western road, the operating results obtained showed very plainly the advantages over a plow using saturated steam.

On this railroad it is necessary to use plows throughout nine months of the year, beginning about the middle of September, and in order to keep the road open in the face of the numerous heavy snow storms the plows must be operated at maximum capacity for considerable periods. The operating officers have been highly gratified with the results of superheating this plow and report that it is more economical on coal and water than a plow using saturated steam, because it can be operated indefinitely at full capacity. It has established its superiority over plows using saturated steam in the prompt and effective clearing of the road.

This plow is equipped with the Locomotive Superheater Company's Type A superheater, the arrangement of the super-

heater being similar to that employed on locomotives. The boiler is 11 ft. 2 in. long over tube sheets and the superheater units, of which there are twelve, extend to within 24 in. of the back tube sheet.

CONSERVATION IN FUEL OIL BOILER PLANTS*

BY EDWIN A. ROGERS

The opportunities for waste in a power plant are many and varied, but probably the place where the greatest avoidable loss occurs is in the boiler and furnace. While the furnace is in most cases a part of the boiler itself the losses of fuel, as represented by heat, should be considered separately.

Taking first the furnace we have the following possible losses and the means of preventing them: First, by allowing a greater amount of air than is necessary for proper combustion to enter the furnace, the temperature of the gases leaving the fires and passing across the tubes is considerably reduced. This reduction of temperature in these gases reduces the quantity of heat which will be absorbed by the water through the tubes and thus a large amount of heat which should go into the water goes out the stack. This single item of excess air to the furnace is probably responsible for a greater loss in fuel than all the other losses in the boiler combined. The remedy is simple if proper care is paid to the boiler dampers, particularly the one between the boiler outlet and the flue to the stack, for by closing in on this damper the draft in the boiler is reduced and consequently the amount of air which will be pulled into the furnace. To determine how much the air to the furnace can be reduced an analysis of the flue gases should be made. This analysis can be made in a very few minutes with a simple piece of apparatus, by any plant engineer, so that there is no excuse for any plant allowing this loss to continue. This fuel loss due to excess air is true of coal-burning plants as well as those using oil, and the same remedy applies. Care must be taken, however, to see that the air supply to the furnace is not curtailed to too great an extent, for then incomplete combustion of the fuel would result. This would cause a loss by way of the stack due to unburned gases and also decrease the absorbing power of the tubes, because in all probability a large amount of soot would be deposited on them by the smoke which would accompany the incomplete combustion.

The second furnace loss would be that due to using an excess amount of atomizing steam where oil is the fuel and steam is used for this purpose. The amount of steam required for atomizing really depends to a considerable extent on the furnace conditions and air supply, but where these conditions are proper the atomizing steam should be just sufficient to properly break up the oil. Experience has shown that the average plant uses three to five per cent of the total amount of steam generated for atomizing the oil, whereas this amount can be reduced to approximately one per cent. Of course all of this steam is lost out the stacks; in fact it is a double loss, for the steam after it enters the furnace will be raised to the temperature of the furnace gases, thus taking more heat which should go into the boiler.

Coming to the boiler proper we have first another excess air loss if there are cracks in the brickwork or boiler setting. As there is a draft inside the setting, air will rush in through any slight cracks or openings, thus cooling down the gases passing through inside. To detect these air leaks pass a candle flame or torch along close to the wall where any cracks show, and if air is going in the flame will be pulled in. wherever such leaks occur the cracks should be stopped up with something which will set properly and make a bond with the brick.

Another appreciable loss is that due to radiation from the setting. This loss can be greatly reduced by covering both the top and sides of the boiler with some good insulating material. This insulating material will not only keep the heat in the boiler but if properly put on will prevent a large amount of air from going in. Where the temperature of the walls will be over 500 deg. F. after the insulating material has been put on, magnesia-asbestos covering should not be used, as it disintegrates at a temperature slightly above this. There are various other forms of insulation which have good insulating qualities and will also stand high temperatures.

Coming to the tube surface of the boiler we find two causes of lost heat. As previously stated if soot forms on the tubes it acts as a heat insulator and prevents passage of heat through the walls of the tubes. By having proper combustion, very little soot will be formed, but even when burning oil under apparently good conditions we find a deposit on the tubes, this deposit being of an ashy nature. This deposit should be removed either by scraping it off or blowing it off with a steam jet. A number of recent installations of oil-fired boilers have included soot blowers as part of the boiler equipment.

On the other side of the tube surface we have another heat insulator to contend with in the form of scale which is deposited from the water. This scale prevents heat from passing through the tube to the water and is not only the cause of a heat loss in this respect but also causes tube losses, for when the water cannot get in contact with the tube, the metal becomes so hot that it blisters and burns and it becomes necessary to replace the tube. Naturally the first solution of this difficulty would be to get water which will not scale the tubes. Unfortunately this is seldom possible and we should then try other means to remove or prevent this scale. In most cases the method would be to use a tube cleaner which grinds the scale out, but this is a slow, expensive process. In a plant of any size a water softener would probably be a profitable investment if the water had any great amount of scale-forming material in it. Some plants use boiler compound to soften the scale, but the softening should preferably be done before the water enters the boiler. Probably the best method to assure clean boilers is that recently adopted in several large power plants and consists of using only distilled water for make-up purposes.

Another important item, if the boilers are of the water-tube type, is the condition of the baffles. If the baffles between the different gas passages are not tight the gases will be pulled through by the shortest route to the stack, thus by-passing a large amount of the tube surface. The remedy here is to keep all baffles tight and in good condition.

Other points to be watched on the boiler are the blow-off valves, which must be tight to prevent leakage of hot water, safety valves to prevent steam leaks and all other valves or fittings where leaks of steam or hot water might occur.

Leaving the boilers, the steam passes to pumps, engines or various other steam-driven apparatus and on the way it travels through pipes or valves. If these pipes are covered with a good insulating material the transmission loss is small, but on the other hand if the pipe is bare the loss is large. An uncovered pipe radiates just about ten times the amount of heat that would be radiated if the pipe was covered with one inch of good insulation.

In the engines and auxiliaries all care should be taken to eliminate friction, leaking joints, leaking valves, etc., for all of these things mean waste of fuel. If the engines in a plant are operating condensing, the vacuum should be kept high to get the greatest possible steam economy from the engine. If engines, pumps, compressors, etc., are operating non-

*From a paper presented before the Pacific Railway Club.

condensing, all of the exhaust steam or as much of it as possible should be utilized to heat feed water and fuel oil.

There are a great many small losses in a plant which have not been enumerated, but it is not because they are unimportant. Any leak however small should be stopped, for they add up to a large total.

As stated in the beginning the greatest opportunity for waste is in the boiler, and with this in mind a considerable amount of attention has been paid to eliminating the human element from boiler control. The automatic stoking of coal has been successful for some time and we now have various automatic devices for controlling oil fires, some of which show every indication of being successful. This I believe will be the ultimate solution of our firing problem.

This may all seem very elemental and an old story, but it is something that needs continued repetition to the men in your plants if it is to have an effect. Ask yourself the following questions and if the answer to them is satisfactory you are doing considerable toward fuel conservation:

Is the right amount of air being used for the fires?
Is the atomizing steam cut down to a minimum?
Is the boiler setting tight and well insulated?
Are the boiler tubes clear of soot and scale?
Are all the valves and fittings tight and working properly?
Are your steam pipes covered with insulating material?

These questions cover only part of the plant, but a part which is all-important. It is perfectly safe to make the assertion that the average plant using fuel oil has a preventable loss of at least five per cent and probably ten per cent of its fuel in the boiler room.

VIRGINIAN 2-10-10-2 LOCOMOTIVES

Built for Heavy Grade Pusher Service; Weight 684,000 lb.; Tractive Effort, Compound, 147,200 lb.

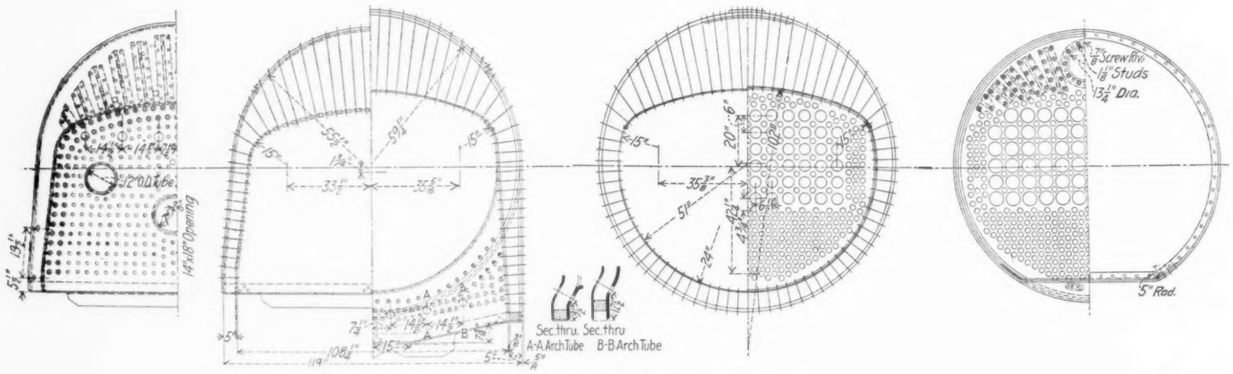
TEN Mallet Locomotives having a tractive effort of 147,200 lb. working compound and 176,600 lb. working simple, are now being delivered to the Virginian Railway by the American Locomotive Company. These locomotives were built to meet the problem of handling a constantly increasing volume of traffic on an exceptionally difficult section of railroad.

The portion of the line between Elmore and Clark's Gap on the Deepwater division, a distance of about 14 miles, has a grade for the last 11½ miles of 2.07 per cent with maximum compensated curves of 12 deg. For the first two and one-half miles the grade is .5 per cent. This 14 miles is all single track and includes five tunnels, which compel the use of an absolute block system. It is the crucial part of the entire system, as all the eastbound tonnage of the Virginian passes over it.

During the last 11 years Mallet locomotives have been employed in handling this traffic. The size and power of these locomotives have progressively advanced to keep pace with the growth in volume of traffic. The first installment consisted of four engines of the 2-6-6-0 type with tractive effort of 70,800 lb. Next in sequence were eight of the same wheel arrangement but with a tractive effort of 90,000 lb. The third installment consisted of one engine of the 2-8-8-2 type with a tractive effort of 100,800 lb. The fourth lot was six 2-8-8-2 type with a tractive effort of 115,000 lb.

At present, trains passing over the mountain section are operated by one 2-6-6-0 type Mallet road engine, with a tractive effort of 90,000 lb., at the head end and two 2-8-8-2 Mallet pusher engines, with a tractive effort of 115,000 lb. each, behind. The maximum tractive effort thus available is 320,000 lb. per train, which enables the handling of 4,500 tons in 60 cars having an average weight for car and load of 75 tons.

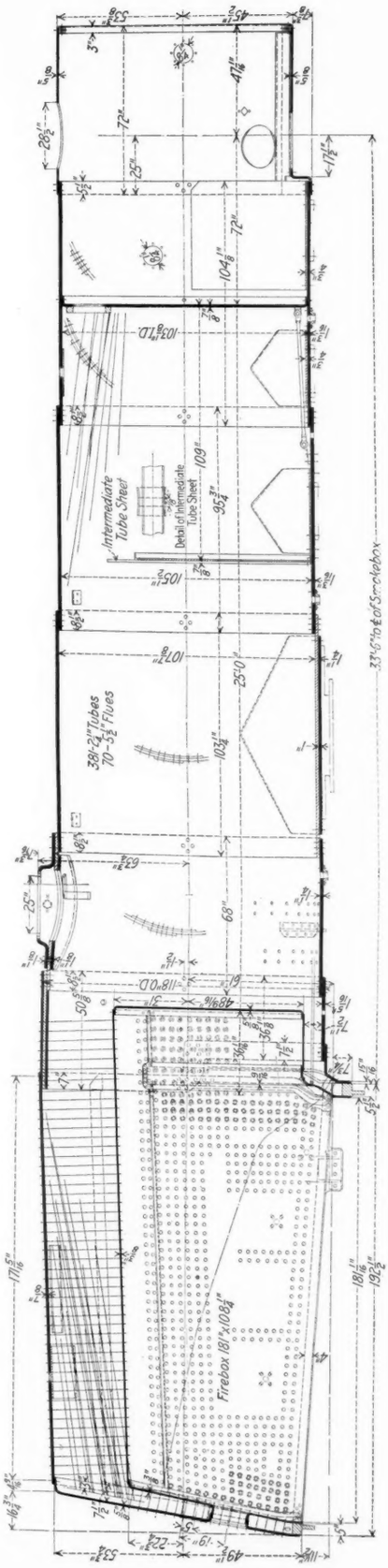
The traffic volume is still growing, and as the track is single, and as it is not desired to increase the number of engines on any train above three, it has been found necessary to put still larger locomotives into service. The unusually large locomotives under discussion were developed in order to accomplish this result.



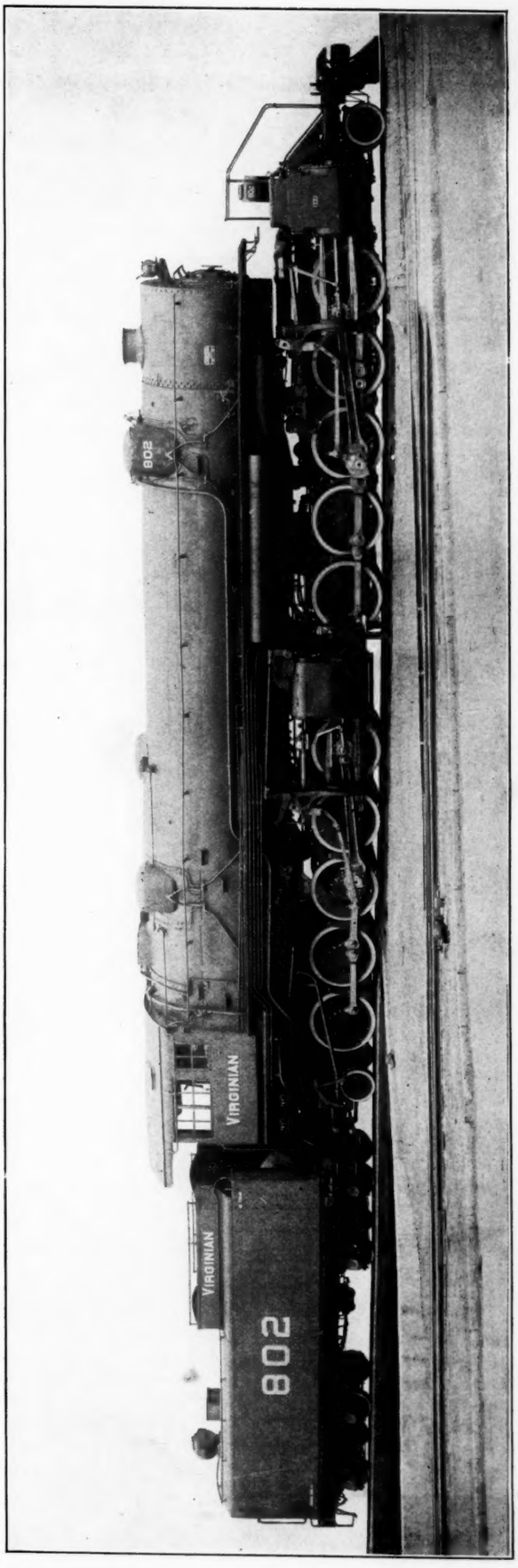
Sections Through the Boiler and Firebox

Upon receipt of the new locomotives trains will be composed of one of the 2-8-8-2 Mallet engines having a tractive effort of 115,000 lb., ahead and two of the new 2-10-10-2 Mallet engines, each having a tractive effort of 147,200 lb., behind, giving a total tractive effort for the train of 409,400 lb. This train will have a weight of 5,850 tons, the equivalent of 78 cars having an average gross weight of 75 tons each.

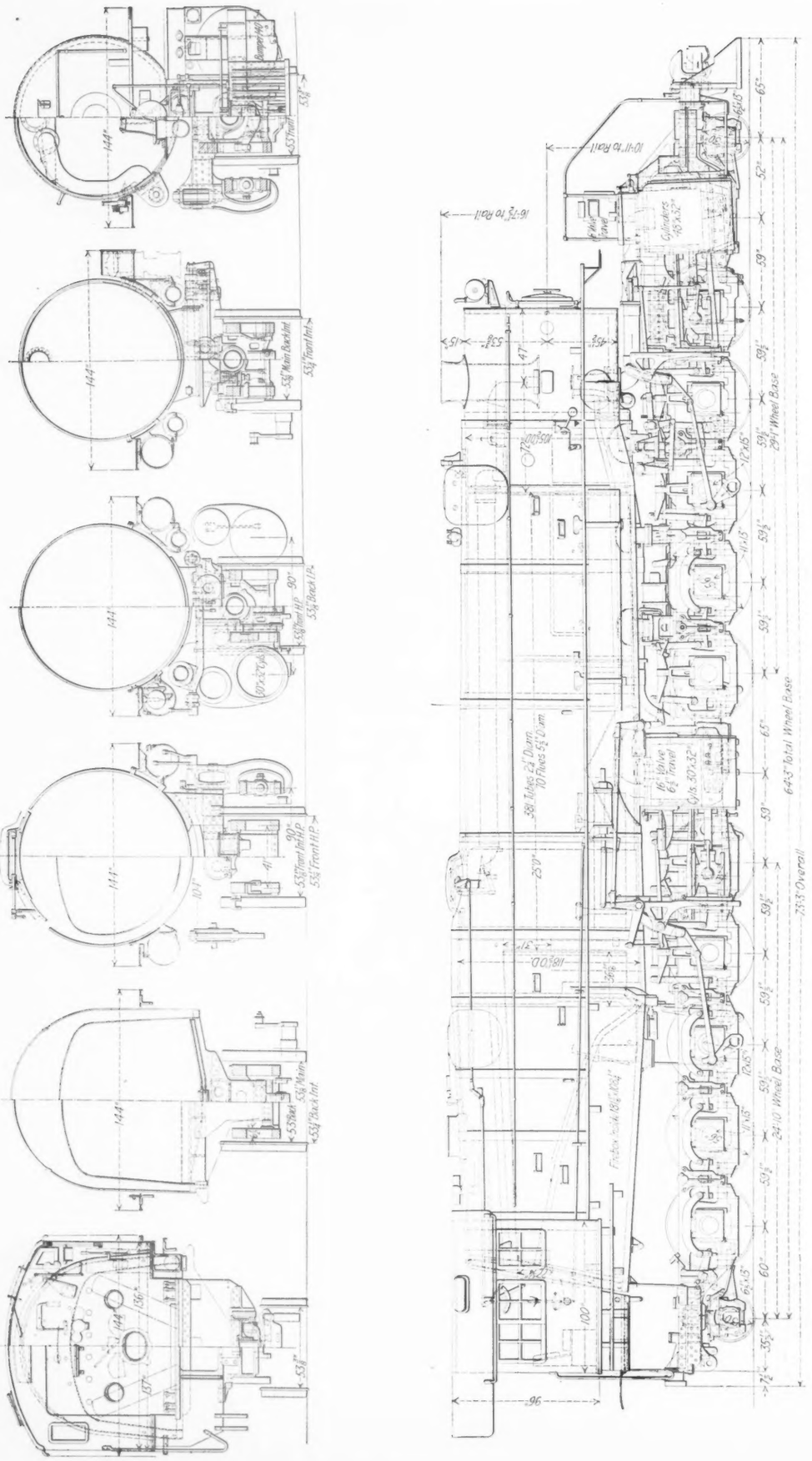
The 2-8-8-2 type Mallets which will be used on the head end of the train were built by the American Locomotive Company in 1912 and 1913. At that time these engines were the most powerful locomotives in the world. The fol-



The Boiler for the Virginian 2-10-10-2 Type Locomotive



The Heaviest Locomotive in Existence—Built for the Virginian by the American Locomotive Company



Elevation and Cross Sections of the Virginian 2-10-10-2 Type Locomotive

lowing comparison shows the extent to which these engines are exceeded in the new 2-10-10-2 type:

	2-8-8-2 type.	2-10-10-2 type.	Per cent. increase.
Total weight of engine, lb	540,000	684,000	26.6
Total weight, engine and tender, lb	752,000	898,300	19.5
Heating surface, sq. ft	6,909	8,606	24.5
Superheating surface, sq. ft	1,311	2,120	61.7
Tractive effort, compound, lb	115,000	147,200	28
Tractive effort, simple, lb	138,000	176,600	28

Apart from the enormous weight and power of the locomotive as a whole, some of the dimensions of the boiler are impressive as showing the extent to which the usual limits were exceeded in its design and construction. At the first course it is 105½ in. in diameter outside, while the outside diameter of the largest course is 112⅞ in. The barrel is fitted with 381 tubes 2¼ in. in diameter and 70 flues 5½ in. in diameter, 25 ft. long. A combustion chamber 36 in. long is included. The firebox is 181 1/16 in. long and 108¼ in. wide. The front portion of the firebox is included with the combustion chamber behind a Gaines fire-wall, so that the grate is about 144 in. long and has an area of 108.75 sq. ft. A total heating surface of 8,606 sq. ft. and a superheating surface of 2,120 sq. ft. are obtained.

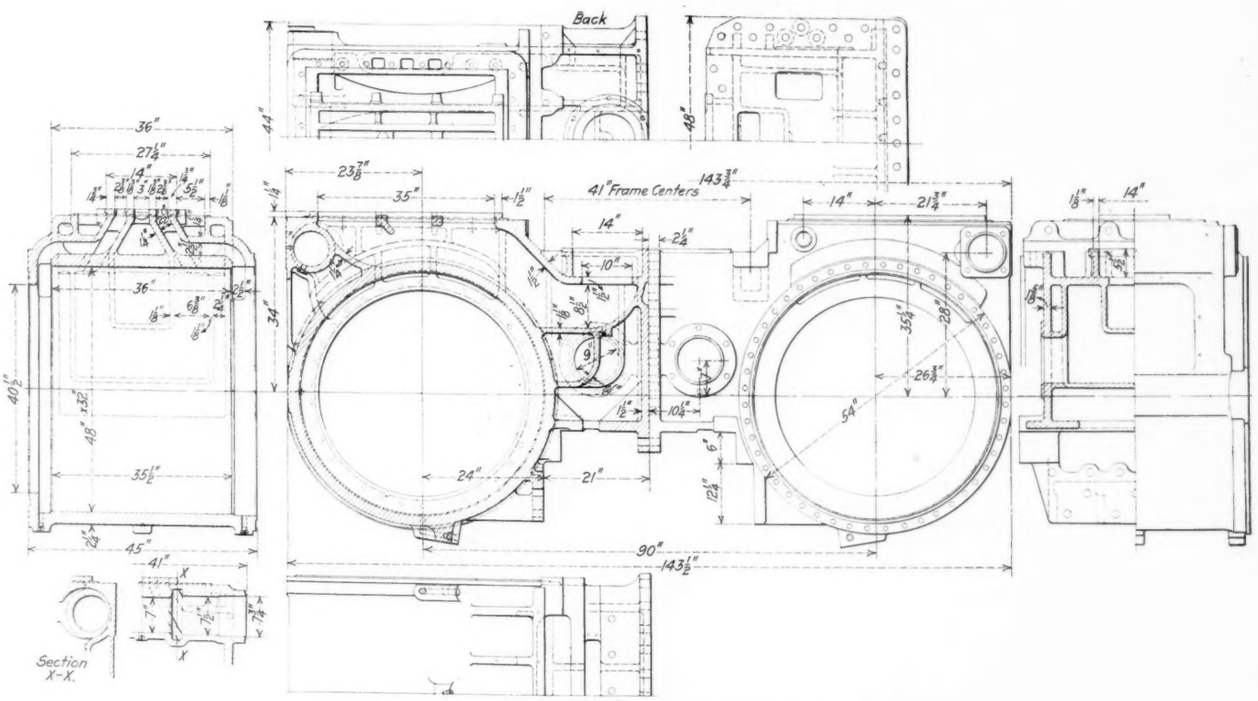
The high and low-pressure cylinders are 30 in. and 48 in. in diameter, respectively, which gives a cylinder ratio of 2.56. The details of the unusually large low-pressure cylinder castings are shown in one of the drawings. With a cylinder spacing of 90 in. between centers the clearance width is 143½ in.

The high-pressure valves are of the piston type, 16 in. in diameter, while outside admission slide valves are used for the low-pressure cylinders. Steam admission is controlled by the Chambers outside connected throttle and a Lewis reverse gear is used. Both the front and trailer trucks are of the Woodward type and the tender trucks are equalized. The design as a whole follows the builder's ordinary practice, differing from previous designs only in modifications made necessary by the increased size and capacity.

These engines were built at the Schenectady works and the contract called for delivery completely erected and ready for service on Virginian tracks. The shipping arrangement required considerable planning before the various carriers could be convinced that they could safely accept and move via their lines, locomotives of such size and weight.

In preparing for shipment of large locomotives it is first necessary to submit diagrams showing the estimated height and width clearance dimensions, and the distribution of weights on each axle to the operating or engineering department of each carrier over whose line it is intended to route the shipment, in order to secure their agreement to handle it when offered to their line. If some projection exceeds the carrier's clearance limitations, an effort is made to meet the objection by removing that part, if possible, and reapplying it on arrival at destination. Or, if the weights are too heavy for the trestles or the bridges via a natural route, an effort is made to find a way to ship via a detour route.

These large locomotives presented an unusual problem. It was impossible to ship them completely assembled and moving dead on their own wheels. After the consideration of many plans, it was finally decided to leave the boiler on the frames but trimmed of all outside parts and projections. The cab, low-pressure cylinders, and some other parts were removed and the remaining skeletons with their tenders were shipped on their own wheels. Each locomotive required one flat, one gondola, and one box car to carry the loose and detached parts.



Low Pressure Cylinders of the Virginian Mallet Type Locomotive

Authority was eventually secured for shipping in this manner although under special operating instructions and via detour routes. Each locomotive was accompanied by a messenger who had sleeping quarters fitted up in the cab which was loaded on a flat car. Approximately two weeks has been the actual running time from Schenectady, N. Y., to Princeton, W. Va.

The principal data and dimensions are as follows:

General Data

Gage	4 ft. 8½ in.
Service	Freight
Fuel	Bit coal
Tractive effort, simple	176,600 lb.
Tractive effort, compound	147,200 lb.
Weight in working order	684,000 lb.

Weight on drivers	617,000 lb.
Weight on leading truck	32,000 lb.
Weight on trailing truck	35,000 lb.
Weight of engine and tender in working order	898,300 lb.
Wheel base, driving	19 ft. 10 in.
Wheel base, total	64 ft. 3 in.
Wheel base, engine and tender	97 ft.

Ratios

Weight on drivers ÷ tractive effort, simple	3.2
Weight on drivers ÷ tractive effort, compound	4.2
Total weight ÷ tractive effort, compound	4.6
Tractive effort, compound × diam. drivers ÷ equivalent heating surface*	699.4
Equivalent heating surface* ÷ grate area	108.4
Firebox heating surface ÷ equivalent heating surface,* per cent	4.4
Weight on drivers ÷ equivalent heating surface*	52.4
Total weight ÷ equivalent heating surface*	58.0
Volume equivalent simple cylinders	41 cu. ft.
Equivalent heating surface* ÷ vol. cylinders	287.4
Grate area ÷ vol. cylinders	2.7

Cylinders

Kind	Compound
Diameter and stroke	30 in. and 48 in. by 32 in.

Valves

Kind	h. p. piston; l. p., slide
Diameter	h. p., 16 in.
Greatest travel	h. p., 6½ in.; l. p., 6 in.
Steam lap	h. p., 1 in.; l. p., 1⅛ in.
Exhaust clearance	h. p., ¼ in.; l. p., 9/16 in.
Lead in full gear	h. p., ⅛ in.; l. p., 3/16 in.

Wheels

Driving, diameter over tires	56 in.
Driving, thickness of tires	3½ in.
Driving journals, main, diameter and length	12 in. by 15 in.
Driving journals, others, diameter and length	11 in. by 13 in.
Engine truck wheels, diameter	30 in.
Engine truck, journals	6½ in. by 13 in.
Trailing truck wheels, diameter	30 in.
Trailing truck, journals	6½ in. by 13 in.

Boiler

Style	Ext. wagon top
Working pressure	215 lb. per sq. in.
Outside, diameter of first ring	105½ in.
Firebox, length and width	181 1/16 in. by 108¼ in.
Firebox plates, thickness, all	⅜ in.
Firebox, water space	Front, 5½ in.; sides and back, 5 in.
Tubes, number and outside diameter	381—2¼ in.
Flues, number and outside diameter	70—5½ in.
Tubes and flues, length	25 ft.
Heating surface, tubes and flues	8,090 sq. ft.
Heating surface, firebox, including arch tubes	516 sq. ft.
Heating surface, total	8,606 sq. ft.
Superheater heating surface	2,120 sq. ft.
Equivalent heating surface*	11,786 sq. ft.
Grate area	108.7 sq. ft.

Tender

Tank	Water bottom
Frame	Cast steel
Weight	214,300 lb.
Wheels, diameter	33 in.
Journals, diameter and length	6 in. by 11 in.
Water capacity	13,000 gal.
Coal capacity	12 tons

*Equivalent heating surface = total evaporative heating surface + 1.5 times the superheating surface.

FUEL ECONOMY ON OIL BURNING LOCOMOTIVES

At the recent meeting of the Traveling Engineers' Association the subject of economy on oil burning locomotives was discussed. C. H. Holdredge, Southern Pacific, expressed the opinion that excess air is responsible for many of the difficulties encountered in the operation of oil burning locomotives, as it is the principal cause of firebox leaks. In his opinion with burners situated at the front of the firebox the best practice was to admit about 60 per cent of the air at the burner and the remaining 40 per cent at the point where the direction of the flame is changed. Analysis of the front end gases had made it possible to determine the arrangement which gave the most efficient combustion. F. P. Roesch, fuel supervisor, U. S. R. A., advocated the use of brick arches on oil burning locomotives. He stated that he had found the use of a burner at the back end of the firebox in conjunction with a brick arch gave better results than the front end burner with a flash wall. In using the brick arch it had been found necessary to alter the oil valve so that a pilot light was kept burning continuously. This prevented explosions from sudden ignition, which often knocks down the brick work. Mr. Roesch spoke of the necessity of protecting fuel oil in storage from the heat of the sun, which in warm climates distills off the lighter constituents of the oil.

The question of oil burning locomotives causing fires along the right-of-way was discussed at length. It developed that there was considerable difference of opinion on this subject. Some of the members stated that they were having no trouble, while others expressed the opinion that oil burning locomotives set out fires as frequently as locomotives burning coal. The causes of fires suggested were, combustible matter in the sand used for cleaning the flues, carbon deposits forming on the heating surfaces and tar in the oil. Some roads reported that they were using netting in the front end or over the stack to break up combustible matter. Trouble due to tar in the oil could only be corrected by more careful refining.

RAILROAD ADMINISTRATION NEWS

The allocation of freight cars and locomotives ordered by the Railroad Administration to the various railroads has encountered some obstacles because many railroad companies are displaying considerable reluctance to accept and pay for the standard equipment. The original plan was to have the Railroad Administration acquire the cars and locomotives with the idea of disposing of them to the railroad companies after the period of government control is over if the railroads are returned to their owners. This plan was changed, however, and the 100,000 freight cars and the 1415 locomotives ordered were definitely allocated to the railroad companies to be charged against their budgets and financed by the companies. The roads were asked how many of the standard locomotives they desired and they placed their orders for various numbers, in some instances, at least, because there was no opportunity to secure any other engines.

About September 1 some of the car builders began to turn out the new freight cars in considerable quantities but a large number of roads have objected to accepting them. Most of the objections have been on the ground that the companies did not want to pay for the cars at the high prices prevailing this year as all the revenue from their use goes to the Railroad Administration and the companies can get nothing but interest and the amount of the depreciation. In other cases the objection was to the type of the standard cars. The Railroad Administration is taking the position that the companies must take the cars and pay for them.

VIOLATION OF SAFETY LAWS

In General Order No. 46 the director general states that the records of the Interstate Commerce Commission and the reports of its inspectors show so many instances of violation of federal statutes for the promotion of safety that it is evident that sufficient attention is not being paid to the provision of General Order No. 8 issued on February 21 that the safety laws, and orders of the Interstate Commerce Commission made in accordance therewith, must be fully complied with. Enforcement of the provisions of this paragraph of the order will be placed under the direction of Frank McManamy, assistant director of the division of operation, who will receive reports of such violations and handle them either with the regional directors, or direct, if necessary.

The Division of Operation has also issued Mechanical Department Circular No. 3 signed by Mr. McManamy, stating that attention has been brought to numerous instances where it has been necessary for Interstate Commerce Commission inspectors to order locomotives out of service for repairs under circumstances which indicate wilful violation of the federal laws regarding safety and also where locomotives were not in condition to render efficient and economical service. In the future, the circular says, master mechanics and shop and roundhouse foremen will be required to know that locomotives are in good condition before they leave the terminals.

PURCHASING COMMITTEE TO ORGANIZE STORES DEPARTMENT

E. J. Roth, purchasing agent of the Chicago, Indianapolis & Louisville, is to be appointed manager of a stores section being organized by the Central Advisory Purchasing Committee of the Railroad Administration to exercise jurisdiction over the storekeeping departments of the railroads, some of which are now under the jurisdiction of the purchasing department, but some of which are under the jurisdiction of the operating department. It is proposed to organize a staff of storekeeping officials, one for each region reporting to Mr. Roth and to work out uniform plans for handling this department.

POLITICAL ORDER MODIFIED

Director General McAdoo has agreed to a slight modification of his General Order No. 42, requiring railroad men to abstain from political activities. The changes are incorporated in General Order No. 48 issued as a substitute for No. 42 and Supplement No. 1 thereto.

"It is ordered that no officer, attorney or employee shall:

"1. Hold a position as a member or officer of any political committee or organization that solicits funds for political purposes.

"2. Act as a chairman of a political convention or use his position in the railroad service of the United States to bring about his selection as a delegate to political conventions.

"3. Solicit or receive funds for any political purpose or contribute to any political fund collected by an official or employee of any railroad or any official or employee of the United States or any state.

"4. Assume the conduct of any political campaign.

"5. Attempt to coerce or intimidate another officer or employee in the exercise of his right of suffrage. Violation of this will result in immediate dismissal from the service.

"6. Neglect his railroad duties to engage in politics or use his position in the railroad service of the United States to interfere with an election. An employee has the right to vote as he pleases, and to exercise his civil rights free from interference or dictation by any fellow employee or by any superior, or by any other person. Railroad employees may become candidates for and accept election to municipal offices where such action will not involve neglect on their part of their railroad duties, but candidacy for a nomination or for election to other political office, or the holding of such office, is not permissible. The positions of notaries public, members of draft boards, officers of public libraries, members of school or park boards, and officers of religious and eleemosynary institutions are not construed as political offices.

"7. In all cases where railroad officers, attorneys and employees were elected to political offices prior to the issuance of General Order No. 42, August 31, 1918, they will be permitted to complete their terms of office so long as it does not interfere with the performance of their railroad duties. After the completion of said terms of office, they will be governed by the provisions of this order.

"8. In all cases where railroad officers, attorneys and employees were nominated for political offices, and had become candidates therefor prior to the issuance of General Order No. 42, August 31, 1918, they will be permitted to hold and complete the terms of office to which they may be elected at the general election to be held November, 1918, to the extent that the holding of such offices shall not interfere with the performance of their railroad duties. After the completion of such terms of office, they shall be governed by the provisions of this order.

"Railroad men have given ample proof of their loyalty to their government. I am confident that they will gladly and patriotically accept now those reasonable governmental regulations concerning political activity which their welfare and America's cause demand. They are the same regulations in their general scope and application as all other government employees have lived under for many years without the loss of any essential rights and with added dgnity to their citizenship."

The new order was approved by President Wilson by his signature.

FREIGHT CAR OUTPUT IN 1918

The total addition to the freight car equipment of the country up to September 1 this year has been approximately 40,000 cars, according to reports recently compiled. This includes private cars and tank cars. The total output of the car builders up to August 31 was 63,139, including 27,718 for the army and navy and foreign governments, and in addition the output of the railroad shops for the first six months of the year was 4,414. The number of freight cars on order and undelivered on August 31 was 106,172 for domestic service, and 55,835 for foreign service, the total for domestic service including the 100,000 cars ordered by the Railroad Administration, of which some 500 have since been delivered.

DELIVERIES OF STANDARD LOCOMOTIVES

Of a total of 626 locomotives delivered to the railroads from August 1 to October 19, inclusive, 284 were of the U. S. R. A. designs, being distributed as follows:

Atlanta & West Point	1	8-Wheel Switcher
Baltimore & Ohio	37	Light Mikados
Central of New Jersey	10	Heavy Mikados
Chesapeake & Ohio	10	Heavy Mikados
Chicago & Alton	7	Light Mikados
Chicago & Eastern Illinois	15	Light Mikados
Chicago, Milwaukee & St. Paul	38	Heavy Mikados
Chicago Junction	10	6-Wheel Switchers
Cleveland, Cincinnati, Chicago & St. Louis	6	Light Mikados
Erie	8	8-Wheel Switchers
Grand Trunk (Eastern)	10	Light Mikados
Lake Erie & Western	15	Light Mikados
Lehigh & Hudson River	4	Light Mikados
Lehigh Valley	5	Light Mikados
Louisville & Nashville	20	Heavy Mikados
New York, Chicago & St. Louis	10	Light Mikados
Pittsburgh & West Virginia	3	Light Mikados
Pittsburgh, McKeesport & Youghiogheny	10	Light Mikados
Seaboard Air Line	10	Light Mikados
Toledo & Ohio Central	5	8-Wheel Switchers
Toledo & Ohio Central	15	Light Mikados
Union Pacific	20	Light Mikados
Western & Atlanta	1	8-Wheel Switcher
Wheeling & Lake Erie	14	Heavy Mikados

RAILWAY SHOPS HELPING OUT THE BUILDER

At the request of the Baldwin Locomotive Works, the mechanical department of the Railroad Administration has ascertained that at some shops there are machines which are not being used to maximum capacity and arrangements have been made to allow the surplus capacity to be used on work for the Baldwin company.

The Philadelphia & Reading shop at Reading, Pa., will plane and slot locomotive frames at the rate of two per week and will build new boilers at the rate of one per week.

The Delaware, Lackawanna & Western will plane and slot 50 sets of frames and finish 50 sets of rods per week.

The Lehigh Valley shops at Sayre, Pa., will plane three sets of frames per week and the shops at Easton will finish 16 driving boxes per week.

The Erie at its Meadville, Pa., shops will finish shoes and wedges for four locomotives per week and at the Susquehanna shops cylinders for one locomotive per week and frames for three locomotives per week. At its Dunmore shops it will finish driving boxes and shoes and wedges for three locomotives per week.

The New York Central will build new boilers at its West Albany, N. Y., shops.

REPORT ON CONDITION OF LOCOMOTIVES

The table showing the condition of locomotives on the roads controlled by the Railroad Administration for the week ending September 28, 1918, indicates that as far as locomotives are concerned the railroads are in pretty good shape, having a general average of only 14.4 per cent of locomotives

LOCOMOTIVE CONDITION REPORT FOR THE WEEK ENDING SEPTEMBER 28, 1918,

Regions	No. of locos. on line	No. of locos. serviceable	No. of locos. awaiting shop	Locos. out of service 24 hrs. Per cent	Locos. turned out of shop 1918	Locos. turned out of shop 1917	Foreign locos. repaired	Number of employees 1918	Number of employees 1917
Allegheny	10,045	8,617	1,428	14.2	1,863	1,463	36	44,763	39,079
Central Western	11,913	10,066	1,847	15.5	802	655	53	60,924	54,396
Eastern	18,395	15,845	2,550	13.8	1,911	1,585	58	78,991	71,091
Northwestern	9,267	8,011	1,256	13.5	375	357	19	32,368	29,922
Pocahontas	1,968	1,741	227	11.5	194	149	6	10,178	9,537
Southern	6,390	5,428	962	15.0	361	316	29	25,257	22,374
Southwestern	5,148	4,279	869	16.8	377	281	35	22,845	21,139
Total	63,126	53,987	9,139	14.4	6,038	4,806	236	275,326	247,533

in shops. It is particularly gratifying to notice that the number of locomotives turned out of the shops for this week is an increase of 1,277 over the number turned out during the same week of last year. At the same time the number of employees increased 27,793 for the week, over the number employed during the corresponding week last year. During the week 236 locomotives were repaired in shops on foreign lines.

The need for skilled railroad employees has become so great that the Railroad Administration is taking steps to have returned to railroad service those who have enlisted or have been drafted into the military service, but not yet sent abroad, who are not being employed in such a way as to secure the full utilization of their special skill and experience. The purpose is not to interfere with the placing of railroad men in military railway service, but rather to make it possible to spare the men needed for that service without undue depletion of the working forces of the railroads.

COMPENSATION FOR HELPERS—SHOP CRAFTS

Amendment No. 1 to Supplement No. 4 to General Order No. 27, recently issued by the director general provides:

For helpers in the basic trades specified in Supplement No. 4 to General Order No. 27, who, on January 1, 1918, were receiving less than 32 cents per hour, establish a basic minimum rate of 32 cents per hour; to this basic minimum rate, and all hourly rates of 32 cents per hour and above in effect as of January 1, 1918, add 13 cents per hour, establishing a minimum rate of 45 cents per hour.

PHYSICAL EXAMINATION FOR MECHANICS

The Eastern regional director in Order 3000-421, dated October 11, quotes as follows from a communication received from the director, Division of Operation, under date of October 7, in regard to physical examinations required in the employment of the locomotive and car repair organizations:

We continue to receive complaints of unnecessarily rigid physical examinations required in the employment of the locomotive and car repair organizations. Your attention is again invited to the following paragraph in the letter addressed to Mr. Wharton by the director general under date of February 14:

"Mechanics applying for employment will not be denied such employment for any cause other than inability to perform the work. This preference rule will be in effect as long as three-year apprentices or promoted helpers are employed at mechanics' rates."

While I do not intend you to understand that physical examinations should be eliminated, it is clear that the requirements should be decidedly more liberal than in the past, and the fact that an employee cannot pass a satisfactory examination to enable him to participate in relief and benefit associations should not bar him from employment, provided he waives membership in such associations. I understand that men now are in some cases accepted for employment upon such waiver, but only for a period of six months.

ANOTHER SUPPLEMENT TO ORDER NO. 27

The director general has issued supplement No. 6-A to General Order No. 27 by which Supplement No. 6 to General Order No. 27 is amended by adding thereto the following:

Where differences of opinion arise necessitating a formal interpretation of any wage order issued by the director general, and where the question involved is of general application and covers a large number of railroads, application for such interpretation may be made either by a regional director or by the chief executive of the railroad organization representing the class of employees involved or the chairman of any railway board of adjustment or the director of the Division of Labor. Such application shall be sent to the office of the director of labor, and he will record and transmit it to the Board of Railroad Wages and Working Conditions, which will promptly investigate and make recommendation to the director general. Upon the receipt of interpretation from the director general, the director of labor will send such interpretation to the railway boards of adjustment for their information and guidance.

INSPECTION OF ASHPANS AND SPARK ARRESTERS

Mechanical Department Circular No. 5 provides that the following rules will govern in the care and inspection of ashpans and spark-arresting appliances in locomotives used on railroads under federal control:

1. A careful and thorough inspection of every part of the spark-arresting appliances in the front end of locomotives must be made every time the front end door is opened for whatever purpose; but at intervals of not more than seven days, and at the same time the ashpans, hoppers, slides or other apparatus for dumping cinders and dampers, must also be inspected. Observe if the slide or hopper operates properly and closes tight. When conditions such as extreme drought or the state of adjoining property or crops require it, this inspection must be made at least once every 24 hours.

2. A record of condition on arrival must be made under the proper heading on an approved form, immediately following each inspection, with the date made, together with a complete statement of any repairs or renewals required. The above record to be made and signed by the person who made the inspection.

3. Nettings and spark arresters must be put in perfectly tight and serviceable condition before the locomotive is put into service. Renew netting and plates in front end when worn thin or defective, instead of patching them. Ashpans and hoppers must be tight, and dampers, slides or apparatus for dumping cinders must be in good working order, closing tight.

4. Record of repairs and renewals made must be entered under the proper heading on an approved form when repairs have been made, with the date, the entry to be made and signed by the person doing the work.

5. These are the minimum requirements, and local conditions or regulations requiring additional precautions are not affected hereby.

THE PROPER LOCATION OF LOCOMOTIVE CAB FITTINGS

BY HUGH G. BOUTELL

A subject, which up to the present time has not received the attention it deserves from locomotive designers, is that of the proper location of cab fittings on the large engines now being turned out.

In spite of the fact that the growing use of mechanical stokers, power grate shakers and other auxiliary equipment has greatly increased the number of valves, levers and pipes in the cab, the location of only a few of these fittings is determined in the drafting room, the rest being set up according to the best judgment of the men in the erecting shop. Even the reverse and throttle levers and whistle rigging, details the position of which is usually fixed on the engine drawing, are often located with no idea whatever as to convenience of operation.

In talking with a road foreman of engines on one of the large coal-carrying roads, the writer learned that a certain class of freight locomotives, very successful in many respects, was extremely unpopular with the enginemen owing to the unhandy position of the throttle lever. This lever was of the type that hangs vertically downward near the right side of the back-head, and was so short, with the lower end so high up, that in order to get a sufficiently straight pull back to open the valve, the runner had to stand up and use both hands. A longer lever, so mounted that the pull came in a straight line on a level with the engineman's shoulder when seated, would have remedied the trouble, and in fact this change was made on a subsequent lot of engines.

A similar case which came to my attention recently, was the location of the whistle lever on some passenger engines so far forward in the cab that it could not be reached unless the engineman left his seat. Even so slight a movement as this distracts the man's attention and requires time which should be given to other duties. This point has lately been recognized by railroad officers and is one of the reasons for the rapid increase in the use of power reverse gears, which do away with the old hand lever, the movement of which often required all of one man's weight and was even accompanied with considerable danger when attempted at high speed.

A frequent cause of bad language and sometimes of minor injuries to the enginemen is the placing of hot steam pipes in line with injector steam valves and other turret appliances. These should have as clear a space as possible all around them, so that they can easily be reached even in the dark. Of course the satisfactory location of valves and other fittings connected with the turret is a serious matter on large locomotives, where there is but little space between the top of the boiler and the cab roof. A layout of these fittings ought to be made in the drafting room, and the clear-

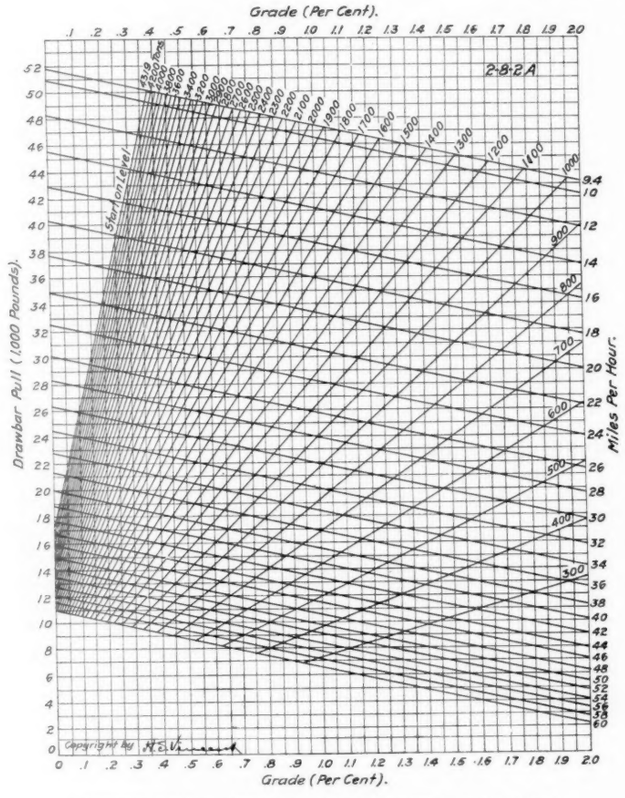
ances worked out with all possible care. The case of valves so located that the cab has to be removed in order to pack the stem would then be avoided.

Considering the great number of levers, valves and other fittings on a modern locomotive, it seems remarkable that they have been arranged even so well as is usually the case, but this has been done more or less in spite of, rather than with the assistance of the designers of the engine. The attitude of the engine crew can do a great deal toward making a certain class of locomotives successful or otherwise, and for this reason alone, the proper location of cab fittings should receive the careful attention of locomotive builders.

DATA FOR STANDARD LOCOMOTIVES

Tonnage Rating Charts and Clearance and Weight Diagrams for the Government Locomotives Now Built

FOR the convenience to railway men handling the standard locomotives built by the Railroad Administration the following charts and diagrams are given, showing tonnage rating charts, prepared by H. S. Vincent, and clearance and weight diagrams, prepared by F. P. Pfahler, chief mechanical engineer, the Division of Operation, U. S. R. A., of the standard locomotives thus far built. As other standard locomotives are constructed similar charts and diagrams will



Tonnage Rating Chart for the Standard Light Mikado.

be published in connection with a description of the locomotives.

TONNAGE RATING CHARTS

The tonnage rating charts * are so designed that the maximum hauling capacity of the locomotives in tons of 2,000 lb. can be read directly from them for any combination of speed and grade within the given limits.

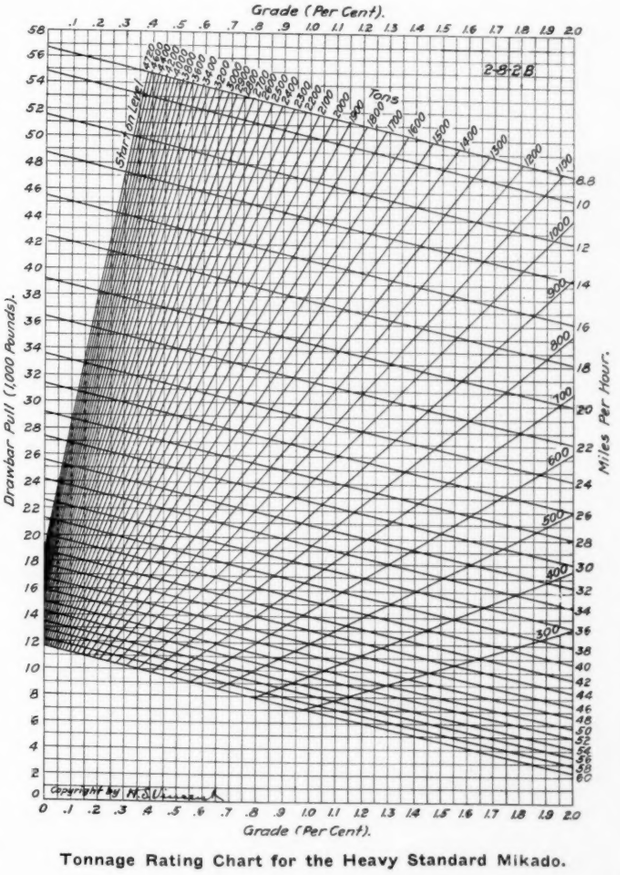
The tractive effort formula used in the calculation of the charts is:

$$T = \frac{d^2 L .85 P}{W}$$

Where: T = Tractive power.
d = Diameter of cylinders in inches.
L = Stroke in inches.
P = Boiler pressure — lb. per square inch
W = Diameter of driving wheels in inches.

The drawbar pull which varies with the resistance is shown on the charts by the inclined parallel lines. On straight level track this equals the tractive effort less the frictional resistance of engine and tender. In determining the latter resistance, the writer has adopted the method proposed by F. J. Cole, in which the engine and tender resistance is made up of the following:

(a) Engine friction or energy required to overcome the



Tonnage Rating Chart for the Heavy Standard Mikado.

friction of the driving wheels, pistons, valves, crossheads, etc., equal to weight on drivers in tons x 22.2 lb.

(b) Resistance of engine and trailing trucks and two-

* These charts have been copyrighted by Mr. Vincent.

thirds of loaded weight of tender assumed to be the same as the cars in the train.

(c) Head air resistance of engine, assumed to be 120 sq. ft. x .002 V^2, in which V = velocity of train in miles per hour.

The tonnage curves are based on a frictional car resistance of four pounds per ton, which is a good average for the usual mixed freight trains with varying weights of cars and loading, when the rolling stock and roadbed are well maintained. However, the tonnage can be read from the charts for any other car resistance factor or any combination

Table I—Frictional Resistance of Freight Cars

Speeds 5 to 30 M. P. H.

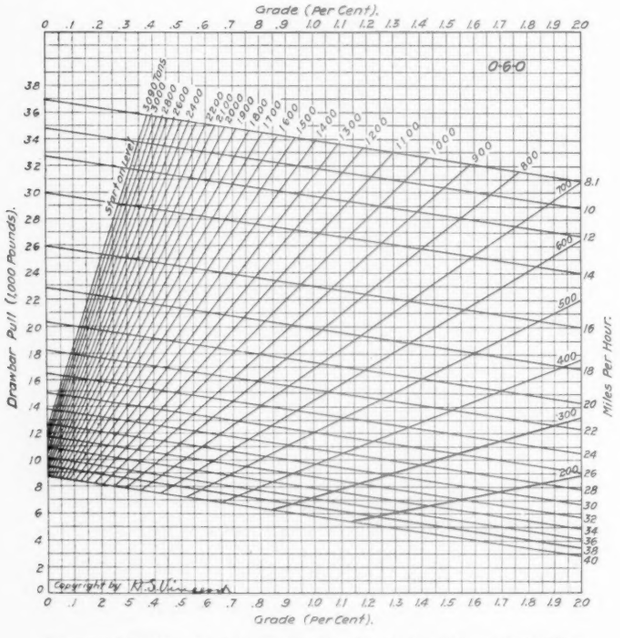
Weight in tons		Resistance (Lb. per ton)	
Loaded	Empty	Loaded	Empty
15	6	6.40	10.30
20	7.8	5.91	9.60
25	9.5	5.44	9.05
30	11.1	5.07	8.45
35	12.6	4.74	8.05
40	14.0	4.40	7.65
45	15.3	4.18	7.26
50	16.5	3.90	6.85
55	17.6	3.65	6.50
60	18.6	3.43	6.26
65	19.5	3.24	6.00
70	20.3	3.07	5.82
75	21.0	2.90	5.63

of resistance simply by converting them into terms of grade, using the following multipliers:

One pound car resistance = .05 per cent grade.

One degree curve uncompensated = .04 per cent grade.

For example: Find the tonnage of the light Mikado locomotive on a one per cent grade at a speed of 18 m.p.h., with a mixed train having a frictional car resistance of four



Tonnage Rating Chart for the Standard Six-Wheel Switcher

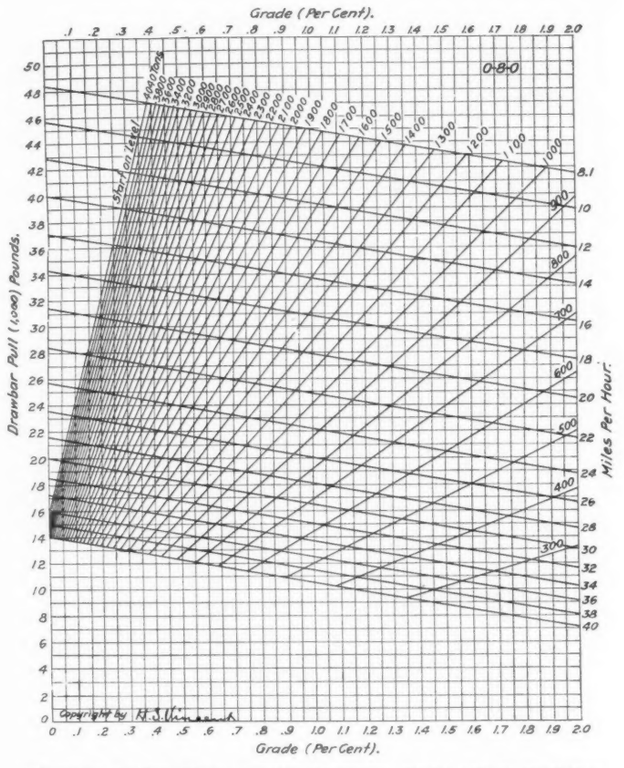
pounds per ton; also with a train of 50 tons loaded coal cars, having a resistance of three pounds per ton.

From the 2-8-2-A chart at the intersection of the ordinate for one per cent grade with the drawbar pull curve marked 18 m.p.h., we find the radial curve reading 1,500 tons.

For the train having 50 ton cars with three pound resistance, we select the ordinate equal to 1 — [(4 — 3) x .05] = .95 per cent grade, which at its intersection with curve for 18 m.p.h., reads 1,575 tons approximately.

Taking the same example and combining the grade with an eight degree uncompensated curve, we have for the mixed train, an equivalent grade of 1 + (8 x .04) = 1.32 per cent, which at 18 m.p.h. gives a rating of about 1,130 tons, and for the train with uniform loads we have an equivalent grade of 1 + (8 x .04) — (1 x .05) = 1.27 per cent, which at 18 m.p.h. gives a rating of approximately 1,180 tons.

For Passenger and Express Service.—To avoid confusion,



Tonnage Rating Chart for the Standard Eight-Wheel Switcher

the charts have been based on a frictional resistance of four pounds per ton, although in every case adjustment must be made for a greater resistance due to increased frictional re-

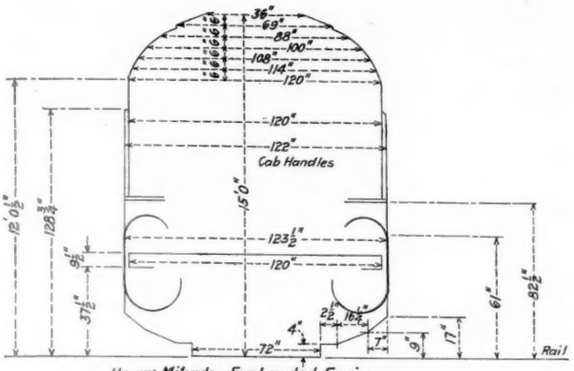
Table II—Frictional Resistance of Freight Cars

From Bulletin No. 43—University of Illinois—Edward C. Schmidt

Speed, miles per hour	Train resistance—Pounds per ton. Column headings indicate average weights per car												
	15	20	25	30	35	40	45	50	55	60	65	70	75
6	7.7	6.9	6.1	5.5	4.9	4.4	4.1	3.8	3.5	3.3	3.2	3.1	3.0
8	8.0	7.1	6.3	5.6	5.0	4.6	4.2	3.9	3.6	3.4	3.3	3.2	3.1
10	8.2	7.3	6.5	5.8	5.2	4.7	4.3	4.0	3.7	3.5	3.3	3.2	3.2
12	8.4	7.5	6.7	6.0	5.4	4.8	4.4	4.0	3.8	3.6	3.4	3.3	3.3
14	8.7	7.8	6.9	6.2	5.5	5.0	4.5	4.2	3.9	3.7	3.5	3.4	3.4
16	9.0	8.0	7.1	6.4	5.7	5.1	4.7	4.3	4.0	3.8	3.6	3.5	3.5
18	9.3	8.3	7.4	6.6	5.9	5.3	4.8	4.5	4.1	3.9	3.7	3.7	3.6
20	9.6	8.5	7.6	6.8	6.1	5.5	5.0	4.6	4.3	4.0	3.9	3.8	3.7
22	9.9	8.8	7.9	7.0	6.3	5.7	5.2	4.8	4.4	4.2	4.0	3.9	3.8
24	10.2	9.1	8.1	7.3	6.6	5.9	5.4	4.9	4.6	4.3	4.2	4.1	4.0
26	10.5	9.4	8.4	7.5	6.8	6.1	5.6	5.1	4.8	4.5	4.3	4.2	4.1
28	10.9	9.7	8.7	7.8	7.0	6.3	5.8	5.3	4.9	4.7	4.5	4.4	4.3
30	11.3	10.0	9.0	8.0	7.3	6.6	6.0	5.5	5.1	4.9	4.7	4.5	4.5
32	11.6	10.4	9.3	8.3	7.5	6.8	6.2	5.8	5.3	5.0	4.9	4.7	4.6
34	12.0	10.7	9.6	8.5	7.8	7.1	6.5	6.0	5.5	5.3	5.1	4.9	4.8
36	12.5	11.1	9.9	8.9	8.0	7.4	6.7	6.2	5.8	5.5	5.3	5.1	5.0
38	12.9	11.4	10.2	9.3	8.3	7.6	7.0	6.5	6.0	5.7	5.5	5.3	5.2
40	13.4	11.8	10.6	9.5	8.6	7.9	7.3	6.8	6.3	6.0	5.7	5.6	5.5

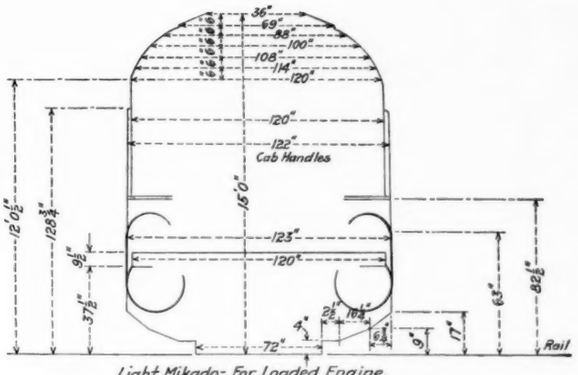
sistance of passenger cars. For example: Find the tonnage which can be hauled by the heavy Mikado in passenger service on 0.5 per cent grade combined with six degree curve at 40 m.p.h.

From Table III we find the resistance for passenger



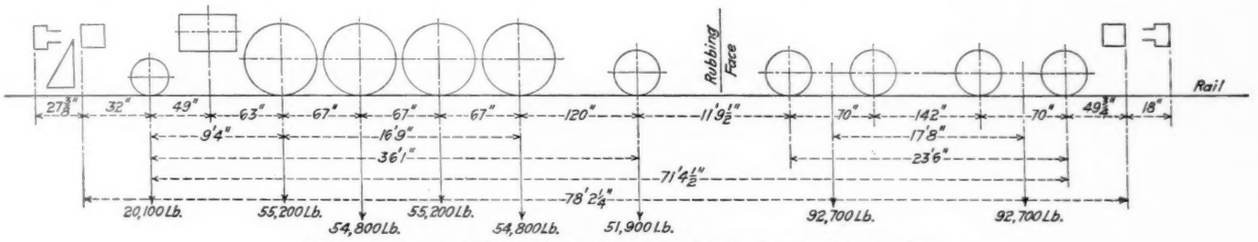
Heavy Mikado - For Loaded Engine.
For Light Engine, Heights Will Be About 1½" Greater.

Clearance Diagram for the Standard Heavy Mikado



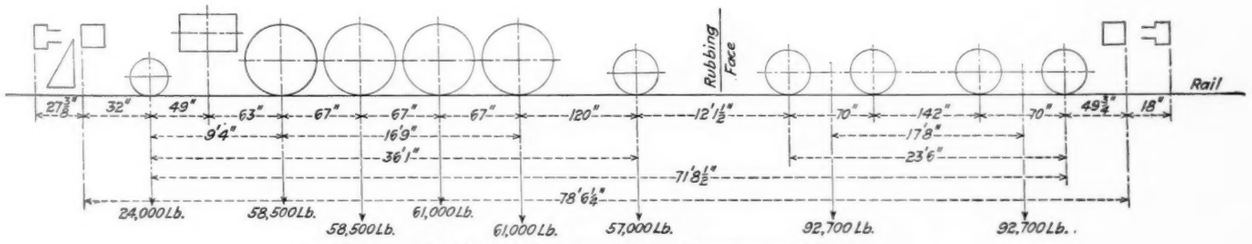
Light Mikado - For Loaded Engine.
For Light Engine, Heights Will Be About 1½" Greater.

Clearance Diagram for the Standard Light Mikado



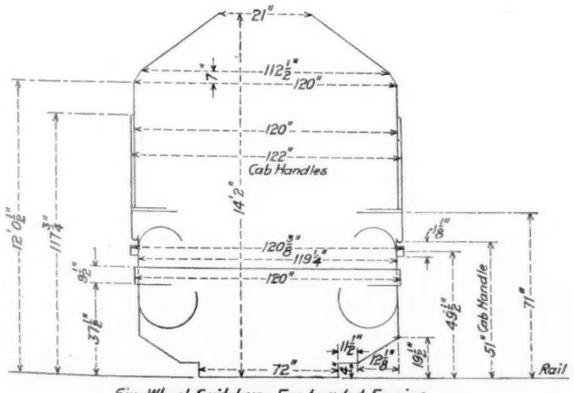
Light Mikado - Weight in Working Order: 10,000 Gal. Tender - Freight Trucks.

Wheel Loading and Spacing Diagram for the Standard Light Mikado



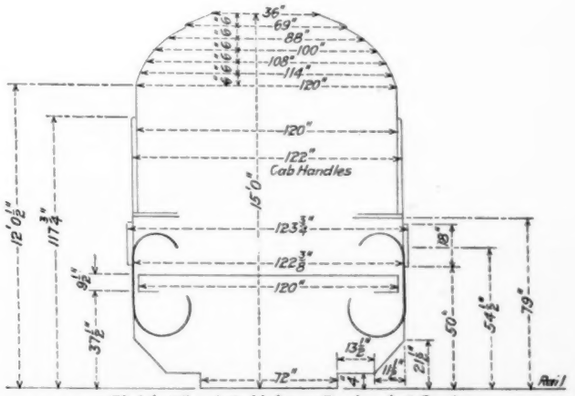
Heavy Mikado - Weight in Working Order: 10,000 Gal. Tender - Freight Trucks

Wheel Loading and Spacing Diagram for the Standard Heavy Mikado



Six-Wheel Switcher - For Loaded Engine.
For Light Engine, Heights Will Be About 1½" Greater.

Clearance Diagram for the Standard Six-Wheel Switcher



Eight-Wheel Switcher: - For Loaded Engine.
For Light Engine, Heights Will Be About 1½" Greater.

Clearance Diagram for Standard Eight-Wheel Switcher

coaches at 40 m.p.h. is 6.65 lb. per ton. The equivalent grade is then:

.5 + (6 x .04) + (2.65 x .05) = .8725 per cent.

From the 2-8-2-B chart at the intersection of the ordinate for .8725 per cent grade with the drawbar pull curve for 40 m.p.h. we find a rating of approximately 730 tons.

The maximum tonnage as given on the charts is that which the engine can start on a level straight track, assuming a starting resistance of 12 lb. per ton for freight trains.

The minimum speed shown on the charts is that equivalent to 250 ft. piston speed per minute, the highest speed at which the locomotive will develop its maximum drawbar pull.

Table I gives the resistance in pounds per ton for varying weights of freight cars; this covers speeds from 5 to 30 m.p.h. and is based on the assumption that the resistance is constant between these limits.

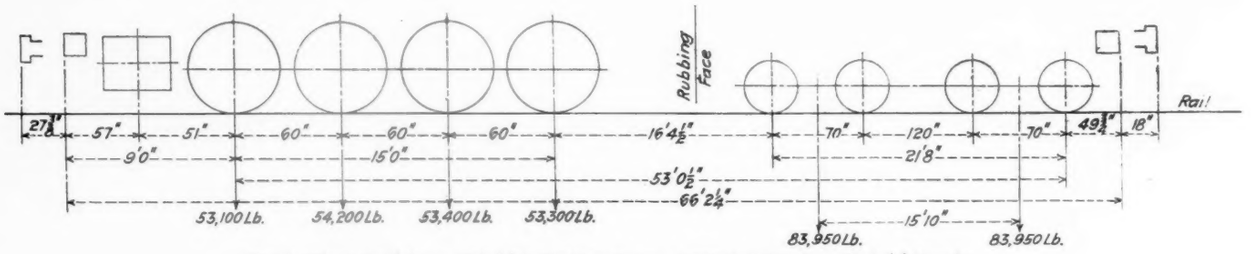
Table II is taken from Bulletin No. 43 of the University of Illinois, and represents tests by Prof. Edward C. Schmidt under actual service conditions. It will be observed that in this table the resistance per ton increases with the speed, and inversely, as the weight of the cars.

Table III gives the resistance for passenger cars at varying speeds. The data for Tables I and III are taken from Bulletin No. 1001, of the American Locomotive Company.

No allowance has been made for weather or temperature conditions or for drop in boiler pressure. In rating the locomotive a fixed percentage should be deducted from the maximum hauling capacity as given in these charts to suit local conditions.

TABLE III—FRICTIONAL RESISTANCE OF PASSENGER CARS

Speed, M. P. H.	Resistance, Lb. per ton	Speed, M. P. H.	Resistance, Lb. per ton
5	5.89	42.5	6.90
7.5	5.60	45	7.20
10	5.51	47.5	7.35
12.5	5.42	50	7.85
15	5.42	52.5	8.30
17.5	5.42	55	8.65
20	5.46	57.5	9.03
22.5	5.48	60	9.45
25	5.60	62.5	9.95
27.5	5.70	65	10.42
30	5.85	67.5	10.95
32.5	5.95	70	11.45
35	6.20	72.5	12.00
37.5	6.40	75	12.60
40	6.65	77.5	13.20
		80	13.85



Eight-Wheel Switcher - Weight in Working Order: 8,000 Gal. Tender - Freight Trucks.

Wheel Loading and Spacing for the Standard Eight-Wheel Switcher

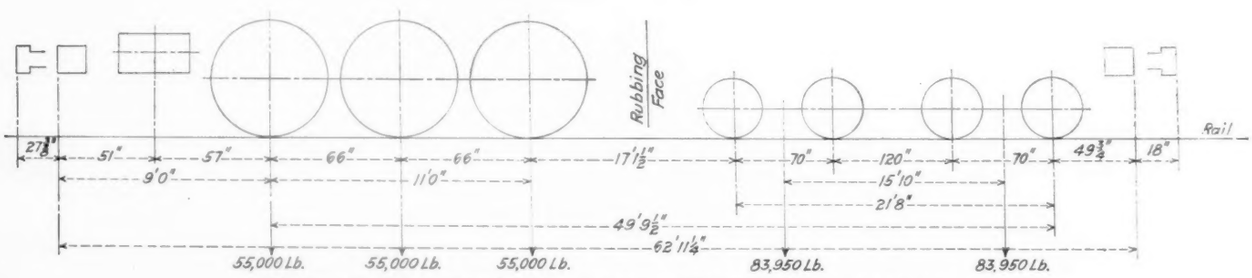
Considerable attention has been given to the clearances of the standard locomotives of the Railroad Administration, F. P. Pfahler, chief mechanical engineer of the Division of Operation of the United States Railroad Administration, has prepared the diagrams shown in connection with this article. They are given for the light and heavy Mikados and the Eight-wheel and Six-wheel switchers and represent the correct diagrams for clearances and give the official distribution of weights of the different locomotives.

CLEARANCE AND WEIGHT DIAGRAMS FOR STANDARD LOCOMOTIVES

For the purpose of presenting in a convenient manner the clearances of the standard locomotives of the Railroad Administration, F. P. Pfahler, chief mechanical engineer of

SPRAYING SURFACES WITH METAL.—The Zeitschrift für Angewandte Chemie describes a process for spraying metals on any kind of surface, using metal melted in an electric arc and blown by means of gas-jets on to the surface to be covered. The arc is produced between two electrodes, one being metallic, and a stream of non-oxidizing gas is directed on the electrode and portions of the melted electrode are carried away in the form of a fine spray, and may be deposited to form a metallic skin on any surface on which they impinge.

A NEW PROCESS OF TEMPERING STEEL.—The Swiss journal, Die Elektroindustrie, gives particulars of a process for removing the temper from hardened steel. The piece to be softened is placed on a plate of iron at red heat and covered by a plate of cold iron. After the whole has cooled, the piece of steel, whatever was its previous quality and degree of hardness, is detempered completely, and can easily be worked without its quality having undergone any change by, for example, decarburization. The method is specially applicable to the unhardening of tools, more particularly punches and dies. Tests have given excellent results, and the method has the advantage that shaped pieces of steel do not show any shrinkage after treatment.



Six-Wheel Switcher - Weight in Working Order. 8,000 Gal. Tender - Freight Trucks.

Wheel Loading and Spacing Diagram for the Standard Six-Wheel Switcher

DESIGN OF SEVENTY-TON COAL CAR WITH TANDEM HOPPERS

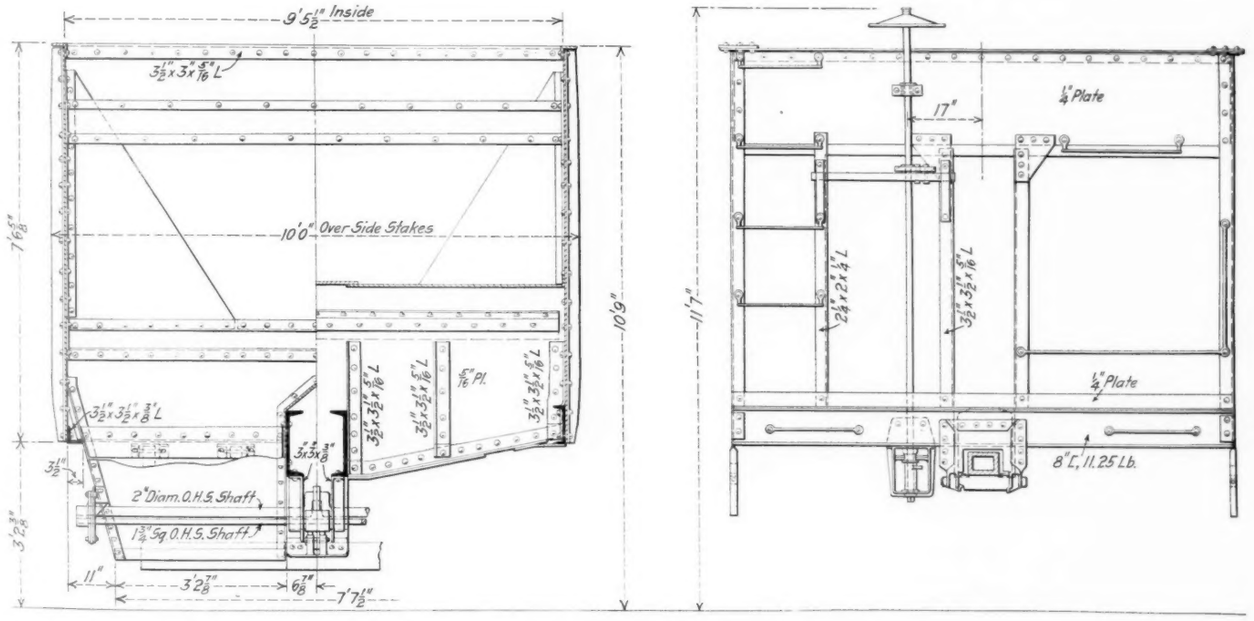
A design for a 70-ton hopper car, the principal features of which are the arrangement of four pairs of inclined doors in tandem and a door operating and locking mechanism operated from either side of the car, has recently been developed and patented by Edward D. Hillman, secretary and engineer of the National Railway Appliance Company, New York. The main dimensions of the cars are:

Length inside	39 ft. 0 in.
Width inside	9 ft. 5½ in.
Height from rail to top of car	10 ft. 9 in.
Truck centers	30 ft. 0 in.
Distance over end sills	40 ft. 4 in.
Capacity	140,000 lb.

In the new design an increase in the cubical capacity of the car is obtained by building a series of four pairs of hoppers beneath the sills. These hoppers are arranged in tandem, two pairs of hoppers being so constructed that one operating mechanism will open both pairs of doors simultaneously. This allows for the quick discharge of coal and half a car can be discharged at a time if desired. The discharge area of two pairs of doors is approximately 27 sq. ft., this insuring a rapid unloading of coal. The hopper arrangement below the sills increases the weight of coal at this point so that the center of gravity of the loaded car is considerably lowered. Eyebolts for adjustment have been eliminated and the adjusting feature is embodied in the link and clevis attachments between the doors and the operating mechanism.

The operating mechanism combines a number of features which are unique in car construction. Two sets of doors are opened simultaneously at one operation and this can be accomplished from either side of the car. All coal cars of the hopper class on the railroads of the country today have their operating mechanisms located on one side of the car only and in dumping such cars on trestles, etc., much time is often consumed by the operator in passing back and forth when a number of cars are to be unloaded. Another feature is that the operator is secure against injury from a too quick opening of the doors. How these improvements have been brought about will be understood from a description of the mechanism.

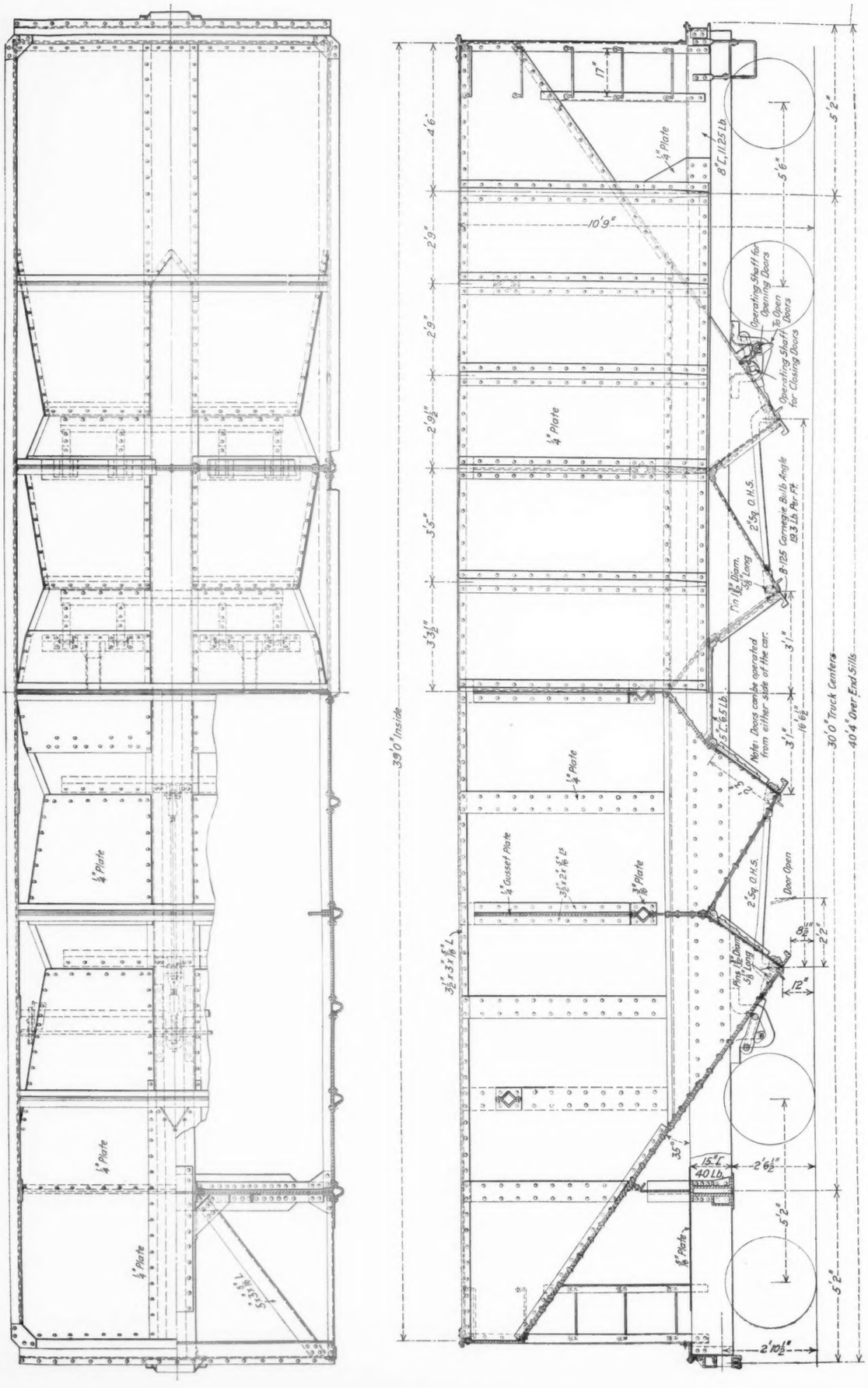
Where the two-inch main shaft crosses underneath the space between the center sills it is formed into a "U" shaped



Cross Sections and End Elevation of the Hillman Hopper Car

link arm to which the main operating link is connected. The ends of this shaft are upset and formed to a two-inch square cross section. Ratchet wheels are attached to the squared ends, each wheel being provided with two teeth. Pawls engage the larger teeth of these wheels when the crank arm is in the locked position with main link over the center. These pawls pass by the center of the 1½-in. square auxiliary shaft, thus locking the pawls against any tendency toward movement away from the ratchet teeth.

Near the ends of the auxiliary shaft are carried small crank arm castings to which are attached the slotted ends of



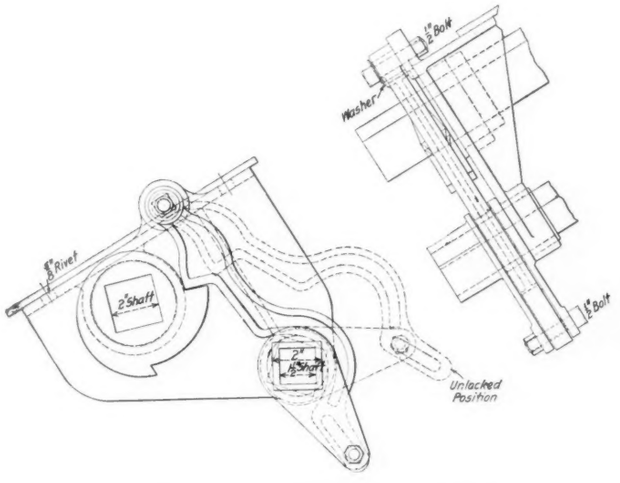
Hillman Seventy-Ton Coal Car with Two Sets of Tandem Hoppers

the pawls. Where the 1½-in. shaft passes through them these cranks are formed with two-inch square bosses which extend to the ends of the shaft, thus providing for the use of a single two-inch wrench on both the main and auxiliary shafts.

A cam is located on the auxiliary shaft between the sills so that it lies beneath the crank arm of the main shaft. This cam acts as a stop for the main shaft when the crank is in such a position that the line of action of the operating link has passed slightly by the center of the shaft. In the construction of this device forgings rather than castings have been used whenever possible.

With the doors closed the operator can turn but one shaft —the auxiliary—in but one direction, and this operation may be performed on either side of the car. As the auxiliary shaft is revolved, the pawls, passing from over the center, are disengaged from the ratchet wheel teeth on both sides of the car. As the disengagement of the ratchet is being completed the cam under the main shaft crank forces up the crank until it crosses the center, when the weight of coal on the doors forces them to open. The operator in the meantime having his wrench on the auxiliary shaft is in no way endangered.

To close the doors, the operator places the wrench on the



Hopper Door Operating and Locking Device

squared end of the main shaft and turns it till the crank arm passes over the center; this forces down the cam on the auxiliary shaft and causes the pawls to engage the teeth on the ratchet wheels. A slight turn with the wrench on the auxiliary shaft will then lock the pawls by bringing them over the shaft center.

The main members of the underframe are 15-in. 40-lb. channel center sills, with 3½-in. by 3½-in. by ⅜-in. angle side sills. The inside longitudinal hopper sheets are made in one piece for each set of hoppers flanged outwardly. Where each sheet passes up over the center sills the flange is riveted to that of the adjoining hopper sheet and the sheets are riveted to the sides of the center sills. Of the lower flanges one forms a surface against which the door closes, while the other acts as a support for the end hopper sheet. This sheet passes up over the hinge angle, giving the proper finish over the door of the next hopper.

The outside hopper sheets are made in one piece, the flanges performing the same functions as those on the inside sheets. At the top of these sheets they are riveted to the side sheets.

Patents have been applied for covering all the special details of construction of this car.

LIMIT OF COST FOR FREIGHT CAR REPAIRS

The division of operation of the Railroad Administration has issued Circular No. 20 relating to the repairs of freight cars. It is in general identical with the instructions issued by the Committee on Standards the latter part of July, which were published in the August issue on page 459. There are, however, a few interesting changes, and the entire circular is given in full below.

LIMIT OF COST FOR REPAIRS TO FREIGHT CARS BELONGING TO RAILROADS UNDER FEDERAL CONTROL

1. Freight cars in need of general repairs will be thoroughly inspected, all defective parts noted, and estimate made showing cost of repairs to place car in general good condition for two years' service barring accident and running repairs. Cars referred to in this circular are cars *which are eligible for interchange under the MCB rules.*

2. Limit of cost for making repairs to wooden freight cars which have not been rebuilt and improved by application of metal draft arms extending beyond body bolster, continuous steel draft arms, steel center sills, or steel underframe:—

(A) IN SERVICE 20 YEARS OR MORE—ALL FREIGHT CARS

	Limit of cost of repairs in kind, labor and material
If equipped with 40,000-lb. capacity trucks or less	$25
Over 40,000-lb., but less than 60,000-lb. capacity	75
60,000-lb. capacity trucks and over	100

(B) CARS IN SERVICE 10 YEARS AND LESS THAN 20 YEARS

	Limit cost of repairs			
	In kind		With betterments	
	All cars except refrigerator	Refrigerator	All cars except refrigerator	Refrigerator
Equipped with 40,000-lb. capacity trucks or less	$25	$100	No betterments to be applied	No betterments to be applied
Over 40,000-lb. but less than 60,000-lb. capacity	100	150		
60,000-lb. capacity and over	200	500	$1,000	$1,200

3. Cars in service over five years and less than ten years and cars found equipped with metal draft arms extending beyond body bolster, continuous steel draft arms with transom draft gear or steel center sills or all steel underframe:—

All cars having trucks 60,000-lb. capacity and over will be repaired *unless* total cost of repairs, including cost of betterments, plus scrap value, exceeds 75 per cent of value of new car.

If cost of repairs exceeds 75 per cent of new car, it will be dismantled and good parts reclaimed for use in repairing cars of similar types. This will apply to existing equipment *only*.

4. *Cars in Service Five Years and Less.*—All cars having trucks 60,000-lb. capacity and over will be thoroughly repaired at cost necessary.

5. Cost of application of safety appliances, wheels, journal bearings, and couplers will not be considered in estimate cost of repairs.

6. All wooden freight cars with trucks 60,000-lb. capacity and over, receiving general repairs, not equipped with metal draft arms extending beyond body bolsters, steel draft arms extending full length of car, steel center sills, steel underframe or transom draft gear, will be equipped with either cast steel draft arms extending beyond body bolsters, steel draft arms extending full length of car, steel center sills or steel underframe. Cars equipped with steel underframes or steel center sills, will have continuous cover plates riveted to the top or bottom of sills, preferably to top.

7. When the cost of repairs in kind exceeds amount allotted to be expended, and betterments are not to be applied, the federal manager, or the general manager on roads having no federal manager, may authorize in writing that the car will be dismantled. Should cost of repairs in kind exceed the amount allotted, and betterments, described in rule 6, are to be applied; if material is not available, car may be sent to owners.

8. When cars are dismantled or sent home to owners for

rebuilding, a detailed statement will be made showing the estimated cost of repairs in kind, by item, and forwarded to owners, showing disposition, and copy retained by handling road.

9. To estimate detailed cost of repairs, add 35 per cent to the sum of applied labor and material.

BAD ORDER CAR SITUATION

A general summary of the bad order car situation taken from the reports of the railroads to the Division of Operation of the Railroad Administration for 10 weeks ending September 21, are interesting in that they show a steady decrease in the number of bad order cars. At the beginning of this period there were 173,771 cars in bad order, or seven per cent of the total revenue cars on the roads then under the jurisdiction of the Railroad Administration, and on September 21 there were 153,798, or 6.2 per cent, a decrease of over 11 per cent. In order to increase the car supply it has been the practice on nearly every railroad to concentrate attention on bad order cars requiring light repairs. This is reflected in Table I giving the summary of the conditions, the light bad order cars decreasing from 87,283 to 62,842. At the same time the heavy bad order cars have been kept well in hand.

The distribution of the bad order cars amongst the different classes by regions as of September 21 is shown in Table II. Box cars comprise 42.5 per cent of the total number, hopper cars 18.2 per cent, gondola cars 25.2 per cent, and the remaining classes all vary below four per cent. It will be seen from this table that the greatest bulk of the bad order box cars are in the Eastern and Northwestern regions. In the Northwestern region they comprise 60 per cent of the cars in bad order. In proportion to the number of cars in the Allegheny region the number of bad order hopper cars is, of course, high.

Referring again to Table I it will be noted that during the 10 weeks in question the number of employees in the car department increased from 134,615 to 146,004, with high weeks of over 150,000. This is an increase of about 14 per cent over the number of men employed a year ago at this time. It is interesting to note that with this increase in the number of employees the average number of bad order cars repaired per working day has not kept pace with the increase in the number of employees, although for the week ending September 14 there was a high record of 99,009. The lowest number reported is for the week ending August 10, when 95,973 cars were repaired per working day with 140,308 employees.

It is also interesting to note the number of cars that have been transferred from one road to another to reduce congestion. This has as a rule steadily increased, except that during the week ending September 21 a less number of cars was transferred than for the previous three weeks. It shows the improvement in co-ordination of the work.

A study of the more detailed freight car condition report for the week ending September 21, Table III, shows that during the week 26,411 cars were damaged in trains in the yards at a cost of $427,710. While this number is a little over one per cent of the total revenue cars, an analysis shows that in the Central Western and Northwestern territory the number of cars damaged in this manner was about two per cent of the total number of revenue cars in that territory. In these regions there is considerable mountainous territory and it may be possible that the general air brake conditions of the cars are responsible for the proportionately large number of cars damaged in this manner.

TABLE I—TEN WEEKS' STATEMENT OF CAR CONDITION REPORTS

	Week ending								
	July 20	July 27	Aug. 3	Aug. 10	Aug. 17	Aug. 24	Aug. 31	Sept. 7	Sept. 14	Sept. 21
Number of roads represented	158	158	143	143	143	143	140	139	139	
Total revenue cars	2,474,787	2,503,828	2,492,749	2,494,408	2,480,792	2,484,381	2,493,145	2,407,798	2,493,730	2,493,074
Bad order cars	173,771	179,670	175,781	173,771	169,539	164,826	157,339	158,133	155,899	153,798
Heavy repairs	86,488	93,533	93,287	94,796	95,798	96,432	91,656	92,301	91,134	90,956
Light repairs	87,283	87,137	82,494	78,975	73,741	68,394	65,683	65,832	64,765	62,842
Percentage of bad order cars	7.0	7.1	7.1	6.9	6.8	6.6	6.3	6.6	6.2	6.2
Ave. B. O. cars repaired per working day	97,719	96,246	97,348	95,973	96,668	96,681	97,027	96,346	99,009	97,077
Heavy repairs	10,292	9,347	9,744	11,961	9,833	10,003	10,359	9,750	10,473	10,442
Light repairs	87,427	86,899	87,604	84,012	86,835	86,678	86,668	86,596	88,536	86,635
Number of cars transferred to other shops	346	215	459	290	1,363	1,750	1,862	2,188	2,501	1,791
Number of employees	134,615	137,360	138,659	140,308	142,895	146,677	150,042	150,006	145,141	146,004

TABLE II—CLASSIFICATION OF BAD ORDER CAR SITUATION AS OF SEPTEMBER 21, 1918, BY REGIONS

Class	Eastern	Allegheny	Pocahontas	Southern	Central Western	Southwestern	Northwestern	All regions
Box	20,912	9,986	1,247	5,570	8,272	3,526	15,449	64,942
Refrigerator	2,018	314	17	260	1,174	239	1,315	5,337
Stock	1,037	234	106	422	2,108	502	1,329	5,738
Hopper	12,418	9,960	1,324	1,454	457	402	1,917	27,932
Gondola	16,637	6,574	1,660	3,052	6,051	1,447	3,197	38,618
Flat	1,512	531	228	1,051	658	322	1,800	6,102
Coke	330	635	103	126	49	6	95	1,344
Miscellaneous	969	267	182	479	814	500	574	3,785
Total	55,833	28,501	4,867	12,394	19,583	6,944	25,676	153,798
Percentage B. O. cars	7.0	7.1	5.4	5.1	5.2	3.2	6.6	6.2

TABLE III—DETAILS OF THE BAD ORDER CAR SITUATION AS OF SEPTEMBER 21, 1918

	All regions	Eastern	Allegheny	Pocahontas	Southern	Central Western	Southwestern	Northwestern
Number of railroads	139	42	15	3	24	20	18	17
Total revenue cars	2,493,074	789,811	398,935	88,869	242,743	372,349	214,266	386,101
Total bad order cars	153,798	55,833	28,501	4,867	12,394	19,583	6,944	25,676
Heavy	90,956	34,553	20,772	3,125	7,012	11,751	4,052	9,691
Light	62,842	21,280	7,729	1,742	5,382	7,832	2,892	15,985
Percentage of bad order to revenue cars	6.2	7.0	7.1	5.4	5.1	5.2	3.2	6.6
Railroads having four per cent bad order or less	61	9	6	1	12	12	14	7
Railroads having more than four per cent bad order	78	33	9	2	12	8	4	10
Number of cars damaged in trains	19,695	2,899	1,832	268	938	6,394	860	6,504
Cost of repairs (Labor)	$121,056	$27,528	$19,378	$3,643	$15,097	$35,791	$7,050	$12,568
Cost of repairs (Material)	$165,827	$41,445	$27,346	$5,960	$21,471	$44,363	$8,447	$16,795
Number of cars damaged in yards	6,716	2,209	1,043	105	404	584	1,609	762
Cost of repairs (Labor)	$58,570	$19,614	$11,355	$2,190	$5,556	$6,578	$4,774	$8,503
Cost of repairs (Material)	$82,258	$27,533	$16,442	$3,090	$9,820	$8,760	$6,418	$9,295
Average number bad order cars repaired each working day	97,077	29,741	10,888	4,507	7,234	12,722	10,787	21,198
Heavy	10,442	2,843	820	274	1,205	2,184	857	2,259
Light	86,635	26,898	10,068	4,233	6,929	10,538	9,930	18,939
Total number cars remaining to be repaired in contract shops	11,649	7,750	1,609	2,092	0	110	0	88
Total number cars in contract shops undergoing and awaiting repairs	4,267	2,652	421	392	532	128	0	142
Number of cars transferred from one road to another to help reduce bad orders	1,791	1,312	163	100	216	0	0	0
Total number of employees	146,004	41,294	19,532	5,227	18,915	25,453	13,403	22,180
Net total increase during the week	1,170	648	6 (dec.)	13	64	183	20	284
Total number of employees for same week of last year	128,457	35,715	15,904	4,948	17,244	22,182	14,466	17,998

CAR DEPARTMENT OF THE MILWAUKEE

Organization and Methods of Handling Light and Heavy Car Repairs with Samples of the Forms Used

WITH the reorganization of the mechanical department of the Chicago, Milwaukee & St. Paul a well founded and complete organization has been established in the car department. The master car builder who reports directly to the general superintendent of motive power has complete charge of all car construction and maintenance matters and all line officers in the mechanical department, whether on the car or locomotive side, report directly to him or his staff on all car problems. The plan of organization is well illustrated by the chart shown in Fig. 1. It will be noted that the plan has been to divide the entire road which covers a territory of 11,000 miles into four districts. The main car shops at Milwaukee, at which a large amount of new work is done, is directly in charge of five general foreman who report to the master car builder's office as do the heads of subsidiary departments, such as the air brake instruction and inspection departments and the car lighting department.

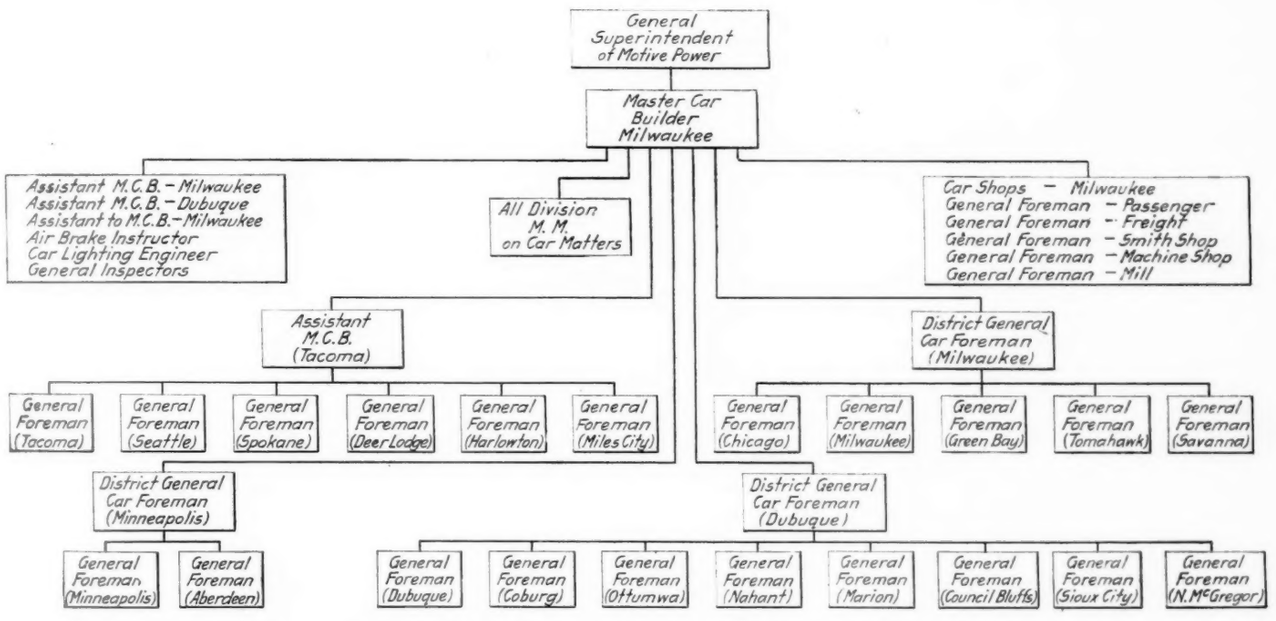


Fig. 1—Organization Chart of the Car Department of the Chicago, Milwaukee & St. Paul

To assist in handling the duties of this office there are on the staff of the master car builder two assistant master car builders who handle committee work in the M. C. B. Association and the American Railway Association and one assistant to the master car builder who handles all of the routine work of the car department. Each district officer has a complete office force in charge of a chief clerk and the manner in which all business is handled has been standardized to agree with the practice followed in the general office at Milwaukee. The districts are further subdivided as indicated in the chart, and placed in charge of general car foremen who are required to visit every shop or repair point under their jurisdiction once every two weeks. The territory covered by these general foremen depends upon the amount of work handled at the different points and the availability of those points to the headquarters of the general foreman. For instance, the general foreman at Dubuque, Iowa, devotes his entire time to the Dubuque shops, which employ 1,000 men. The general foreman at Seattle, Wash., covers repair points at Cedar Falls, Cle Elum, Everett, Bellingham, Kapowsin, Mineral, Hoquiam, Raymond, Port Angeles and Seattle.

CLASSIFIED REPAIRS

There are four main car shops on the system, located at Milwaukee, Wis., Dubuque, Iowa, Minneapolis, Minn., and Tacoma, Wash., respectively. At these points classified repairs to both passenger and freight equipment are made.

Classification of Freight Car Repairs.—All system freight cars brought into the shops are assigned to one of five different classes. Class *A* involves the rebuilding of a car or repairs the expense of which exceeds 50 per cent of the total value of the car, and cars requiring between 60 and 100 hours of labor and from $175 to $540 worth of material. Class *B*, or heavy repairs, includes cars that are seriously damaged or decayed and involves from 30 to 60 hours of labor with $100 to $150 for material. Class *C*, or medium repairs, includes a general overhauling to the cars, involving from 20 to 30 hours of labor and an expenditure of from $50 to $85 for materials. Class D, or light repairs, includes a normal overhauling and the application of couplers, wheels, bolsters and posts, or safety appliances, involving from 10 to 20 hours of labor and an expenditure for material of from $15 to $55. The class *E*, or running repairs, includes repairs made in train yards or repair tracks and involves the application of nuts, cotters, bolts, grab irons, bearings, air hose, train line, brake shaft or any other repairs which are necessary to make the car safe for handling and can be accomplished in the time specified. This involves labor of 10 hours or less.

When the system cars are received on the repair tracks they are examined by inspectors who fill out the form shown in Fig. 2, for cars requiring class *A*, *B* or *C* repairs and the

form shown in Fig. 4, for cars requiring class *D* or *E* repairs. The notations made on these forms govern the repairs to be made and the inspector filling out the form is required to check up the work after it is done and is held responsible for the condition of the repairs made. A carbon copy of this report is tacked on the outside face of the intermediate sill of wood cars or to the floor nailing sill of the steel underframe cars. A carbon copy is also retained in the local car foreman's office and the original, when checked and signed after the work is done, is forwarded to the master car builder's office at Milwaukee.

The cars coming to the shops are to be inspected and classified and the work card made out before the cars are switched in on the repair track, in order that the necessary number of cars of the various classes can be handled to advantage, keeping the handling of light and running repair cars moving as quickly as possible to avoid congestion. In cases where it is impractical to make detail classification before the cars are placed on the repair tracks, a tentative inspection is made so that the cars may be assigned to the proper class and the method of switching may be decided on.

CHICAGO, MILWAUKEE & ST. PAUL RAILWAY CO.

Work Card—For Class A, B & C System Cars

INITIALS_____ CAR NUMBER_____ STATION_____

IN SHOP_____ OUT SHOP_____ CLASSIFICATION_____ FOREMAN_____

CAR BODY				CAR BODY				TRUCKS			
End	ITEM	No. Pieces	Why Made and How Repaired	End	ITEM	No. Pieces	Why Made and How Repaired	End	ITEM	No. Pieces	Why Made and How Repaired
	Car Body—renailed				Grab Irons—side				Arch Bars		
	Car Body—squared				Grab Irons—end				Arch Bar Tie Straps		
	Car Body—repainted				Grab Irons—roof				Bolster—wood		
	Boards—number				Hopper Planks				Bolster—metal		
	Door End (repd.)				Nails				Lag Screws		
	Dump Shaft				Paint—mineral				Staples		
	Dump Shaft Lever				White Lead				Bolts		
	Dump Shaft Casting										
	Flooring										
	End Troughs										
	End Racks										
	Foot Board										
	Yoke—side										
	Yoke—end										
	Gate—end										
	Gate—side										
	Grain Strips										

INSPECTOR_____ (PARTY AUTHORIZING REPAIRS)

HOURS LABOR: CAR REPAIRMEN_____ AIR BRAKEMEN_____ PAINTERS_____ TRUCKMEN_____

INSPECTOR_____ (PARTY MAKING OR CHECKING REPAIRS)

Fig. 2—Work Card for Heavy Repairs to System Cars

Freight cars receiving class *A*, *B* or *C* repairs have the classification of the repairs stenciled on the side of the air brake cylinder, together with the symbol of the station at which the repairs were made and the date of completion. In case a car is rebuilt the following information is stenciled on the car: Capacity of car, clear height inside, clear width inside, clear length inside, kind of brake beam, kind of roof, safety appliances, old light weight, new light weight, cubical capacity and type of truck.

Classified Passenger Car Repairs.—There are four classifications given to the repairs of passenger cars. Heavy repairs include work costing from $900 to $2,000 and where the paint is burnt off. Medium repairs include work costing from $350 to $900 with a coat of varnish. Light repairs include work costing from $25 to $350, where no varnish work is to be done. Running repairs include work costing $25 or less. The passenger cars are examined before they go into the shop and classified. As soon as the extent of the repairs is determined all the foremen at the shop confer and decide as to the date on which the car can be turned out and no excuse whatsoever is allowed for cars not coming out on the date set. The date of completion is placed on a board at each stall, showing when the car is due out and when each craft is supposed to complete the work they have in hand. Weekly and monthly reports are made to show the passenger car output and the cars that are to be shopped. All district general car foremen and general car foremen receive copies of these reports in order that they

S-5-18-200M Form 661-A.

Chicago, Milwaukee & St. Paul Railway Co.

Car No._____ initials_____

Station_____ Rep. Card No._____

Rec'd_____ Rep'd_____ Class_____

On Track_____ Rep'd_____ Pulled_____

END	REPAIRS MADE	SIZE OR WEIGHT OF MATERIAL	WHY MADE

Signature_____ (Party Authorizing Repairs) Signature_____ (Party Making or Checking Repairs)

NOTE. When necessary to renew wheels and axles, couplers, coupler parts, brake beams, brake beam parts, brake shoes, or air hose, it must be specified whether new or second hand material was applied.

Fig. 4—Work Card for Light Repairs

Day of Month	Total Force Allowed	Number of Men in Total Force Allowed for Passenger Work: Number Allowed	Number Reporting to Work	Absentees	Vacancies	Number of Men in Total Force Allowed for Freight Work: Number Allowed	Number Reporting to Work	Absentees	Vacancies	No. of Men in Total Force Allowed for Miscellaneous Work, such as Cleaning Stations, Icing Refg. Cars, Running Pumping Plant: Number Allowed	Number Reporting to Work	Absentees	Vacancies	Was any Work performed not properly chargeable to Car Department, if so, explain in Remarks Column.	REMARKS
1															
2															
3															

Form C. D. 6

Chicago, Milwaukee & St. Paul Railway Company

CAR DEPARTMENT

Daily Record of Forces and Classification of Same

Station_____ Month_____ Foreman in Charge_____

NOTE.—This report is to be made up at each station on the system, kept up to date, one copy being retained by the car foreman, one being sent to the district general car foreman, and the original turned in to the master car builder's office, Milwaukee Shops at the close of each month.

Fig. 3—Form Showing the Distribution of the Working Force

may know those cars that are due for shopping and which will be available for service.

At each of the main shops foremen's meetings are held once every two weeks to discuss subjects that are generally assigned from the main office in Milwaukee. Committees

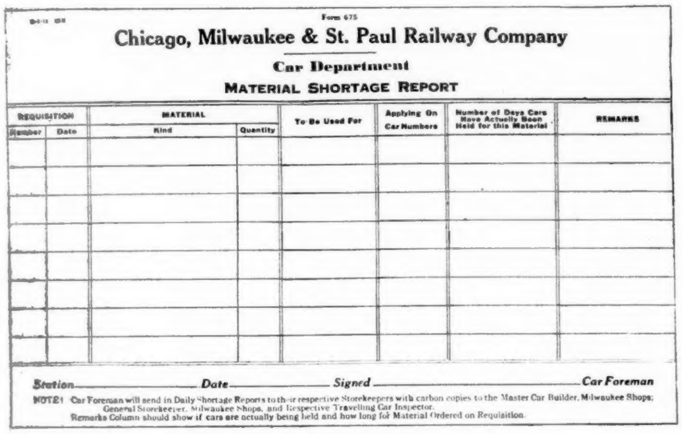


Fig. 5—Material Shortage Report

are formed to investigate and report on various subjects. For instance, one of the questions discussed at the Milwaukee shops was the matter of air supply and it was proposed to provide a system having sufficient radiation to avoid condensation and the resulting freezing of the pipes during the winter season. Another typical subject was that of passenger car trucks, and in this case the committee assigned to investigate the subject visited several large shops in the vicinity of Chicago, obtaining details of the system of handling the work and the costs and methods of construction used. The subject is thoroughly threshed out at these meetings and a definite program determined upon, being made up of the best practices.

The main office in Milwaukee watches carefully the labor conditions and supply of labor over the entire system, and where an abundance of labor is found in a certain district it is possible to transfer help from that district to another in which a shortage exists. This has been carried on successfully and has made it possible to keep the forces up to normal requirements. The form shown in Fig. 3, gives the daily record of the forces used on both passenger and freight work at the different stations and also shows any work done by the employees of the car department not chargeable to that department. In order to properly control the shortage of materials the form shown in Fig. 5, is used, on which the requisitions, the kind and quantity of material, the purpose for which it is to be used, on which cars it is to be used and the number of days the cars have actually been held waiting for this material is shown. These forms are made out daily by the car foremen and sent to their respective storekeepers with carbon copies to the master car builder at Milwaukee, the general storekeeper and the respective traveling car inspectors. They are filled out each day until such time as the material is actually received and men are assigned to follow them up and see that proper action is obtained.

RUNNING REPAIRS

Every effort is made to make running repairs to both passenger and freight equipment as promptly as possible and suitable records are kept of the number of cars held for repairs. A daily telegraphic report (Fig. 6) is submitted by every car repair point showing the number of system cars (loaded and empty) on hand and repaired since the last report, foreign tank cars and other foreign cars, together with the totals. This report also contains information concerning the number of cars held for classified

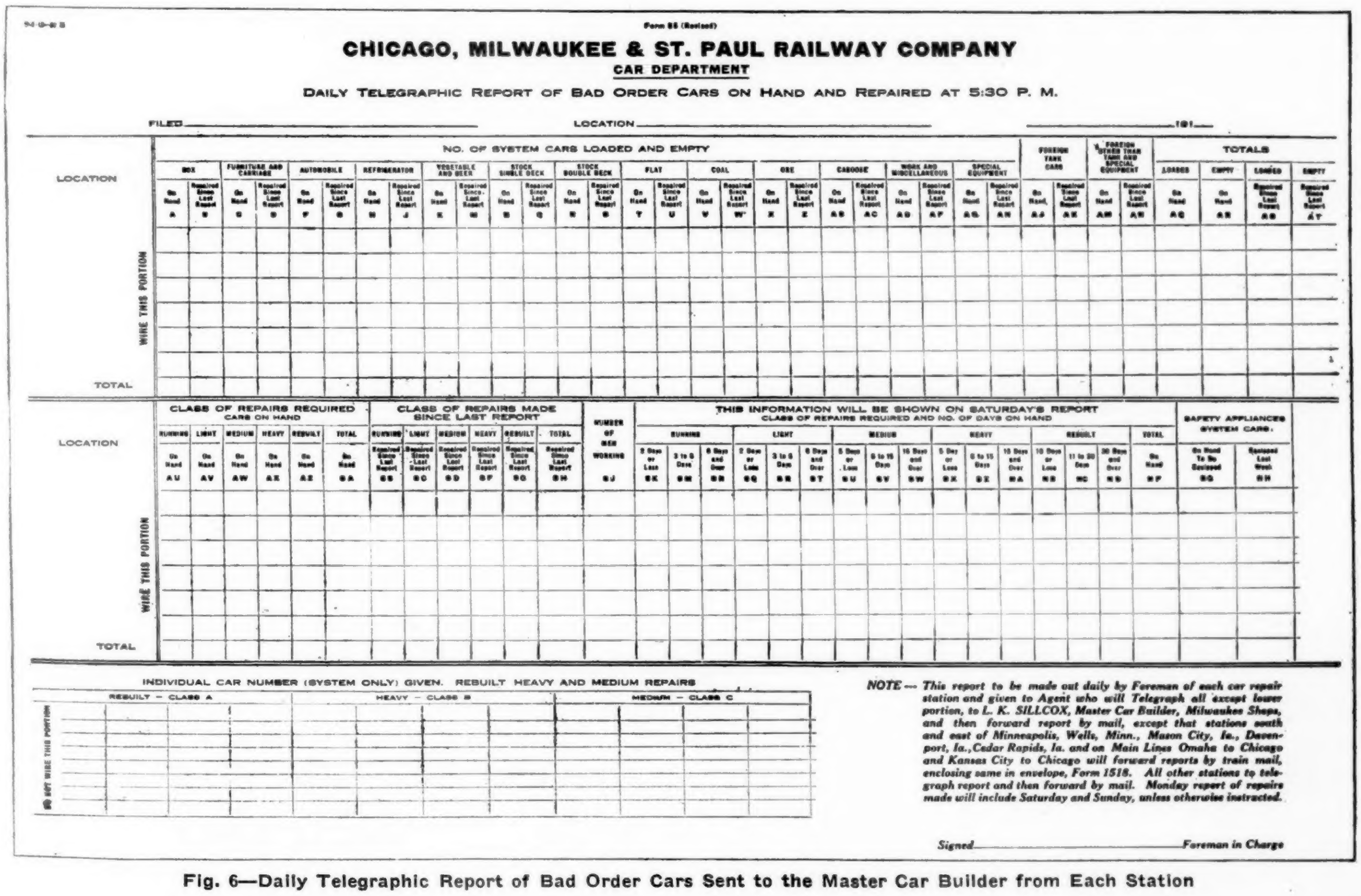


Fig. 6—Daily Telegraphic Report of Bad Order Cars Sent to the Master Car Builder from Each Station

repairs and the number of classified repairs made during the day, which is summarized on the form shown in Fig. 7. A summary of the bad order cars on hand and repaired (Fig. 8) is made from the telegraphic report for every division and station. This report gives the master car builder at a glance the daily condition of the individual stations and the entire system and gives him a close-up view of the performance of all the shops on the system. In this way weak points or any loss in the output of any station will be noted immediately and permit of prompt investigation. The telegraphic reports are held open until the work cards are received and it is known that the proper repairs have actually been made as reported. This gives the master car builder's office an opportunity of knowing just what is being done and of detecting cases of duplicate repairs being made to equipment. A book record is kept and indexed of all repairs made to system cars. For foreign cars the work reports are accompanied by the M. C. B. billing repair

B-6-18 Chicago, Milwaukee & St. Paul Railway Co. Form 671-B

BAD ORDER FREIGHT TRAIN CARS

ON HAND AND REPAIRED 6 P. M. _____ 191__

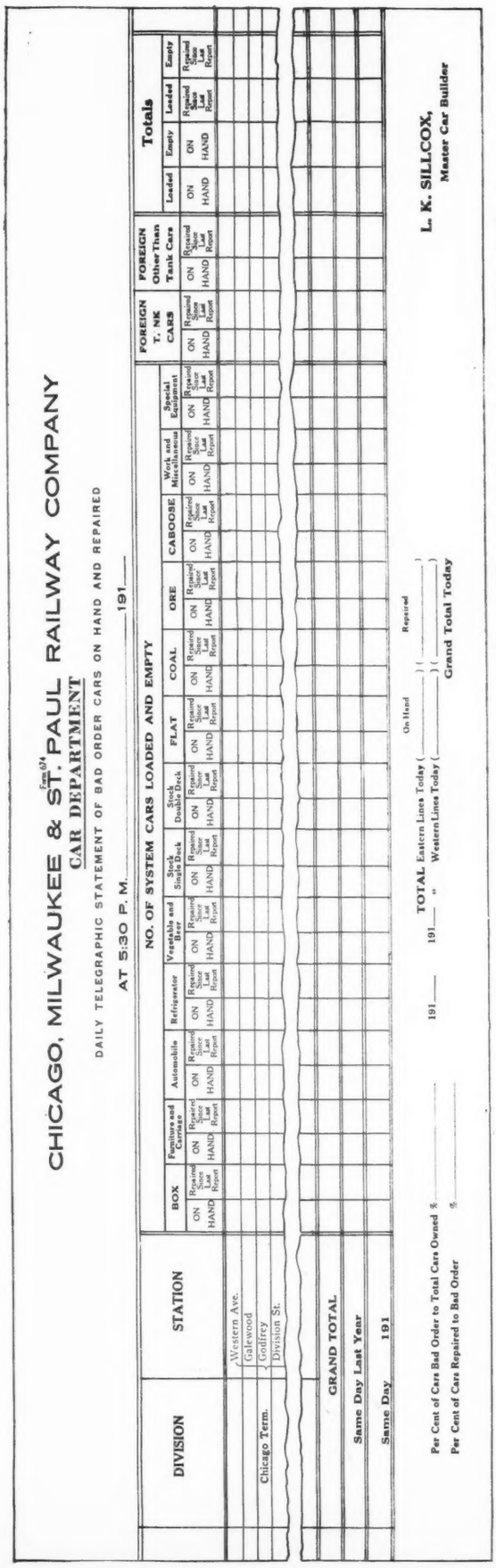
DIVISIONS AND SHOPS	ON HAND					REPAIRED TODAY					MEN	TOTALS ON HAND AND REPAIRED
	RUNNING AND LIGHT	BRAKES	ASSNY	TRUCKS	TOTAL	RUNNING AND LIGHT	BRAKES	ASSNY	TRUCKS	TOTAL		
EAST LINES												
CHICAGO TERMS												
ILLINOIS												
RACINE AND E. W.												
HASTINGS AND DAK.												
SOU. MINN.												
TOTAL DIVISIONS												
SHOPS												
MILWAUKEE												
MINNEAPOLIS												
DUBUQUE												
GREEN BAY												
TOTAL SHOPS												
TOTAL EAST LINES												
% TO REVENUE CARS												
WEST LINES												
TRANS. MO.												
MUSSELSHELL												
NORTHERN MONT.												
ROCKY MOUNTAIN												
MISSOULA												
IDAHO												
COLUMBIA												
COAST												
TOTAL DIVNS												
SHOPS												
MILES CITY												
DEER LODGE												
TACOMA												
TOTAL SHOPS												
TOTAL WEST LINES												
% TO REVENUE CARS												
GRAND TOTAL												
% TO REVENUE CARS												
CO. CARS IN ABOVE												

Milwaukee _____ M _____ 1918 L. K. SILLCOX, M. C. B.

Fig. 7—Summary of Classified Repair Situation.—Information Obtained from Daily Telegraphic Report Shown in Fig. 6

card. Fig. 9 shows a monthly report of the bad order cars at each station, giving the full identification of the cars. By this means it is possible to make certain that no cars are allowed to stand around awaiting repairs over 30 days. In case one point is overloaded the cars are transferred to some other point where repairs can be made.

The equipment being received by the road is in very poor condition, but every endeavor is made to put it in first class condition before it leaves the shop. Where it is found that the cars have received rough handling on the road, the car foremen, who are provided with cameras, take pictures of the condition of the equipment in order that direct evidence may be obtained, and men are assigned to follow up and ferret out the cause for such conditions. When sufficient evidence is obtained the matter is taken up with the operating department and due to the fact that complete



CHICAGO, MILWAUKEE & ST. PAUL RAILWAY COMPANY

Form 674

CAR DEPARTMENT

DAILY TELEGRAPHIC STATEMENT OF BAD ORDER CARS ON HAND AND REPAIRED

AT 5:30 P. M. _____ 191__

DIVISION	STATION	NO. OF SYSTEM CARS LOADED AND EMPTY																								FOREIGN T. NK CARS		FOREIGN Other Than Tank Cars		Totals			
		BOX		Furniture and Carriage		Automobile		Refrigerator		Vegetable and Beer		Stock Single Deck		Stock Double Deck		FLAT		COAL		ORE		CABOOSE		Work and Miscellaneous		Special Equipment						Loaded		Empty	
		ON HAND	Repaired Since Last Report	ON HAND	Repaired Since Last Report	ON HAND	Repaired Since Last Report	ON HAND	Repaired Since Last Report	ON HAND	Repaired Since Last Report	ON HAND	Repaired Since Last Report	ON HAND	Repaired Since Last Report	ON HAND	Repaired Since Last Report	ON HAND	Repaired Since Last Report	ON HAND	Repaired Since Last Report	ON HAND	Repaired Since Last Report	ON HAND	Repaired Since Last Report	ON HAND	Repaired Since Last Report	ON HAND	Repaired Since Last Report	ON HAND	Repaired Since Last Report	ON HAND	Repaired Since Last Report	ON HAND	Repaired Since Last Report
Chicago Term.	Western Ave.																																
	Galewood																																
	Godfrey																																
	Division St.																																
GRAND TOTAL																																	
Same Day Last Year																																	
Same Day 191																																	

TOTAL Eastern Lines Today (On Hand) (Repaired)

" Western Lines Today ( ) ( )

Grand Total Today

Per Cent of Cars Bad Order to Total Cars Owned %. 191__

Per Cent of Cars Repaired to Bad Order %.

L. K. SILLCOX,
Master Car Builder

Fig. 8—Detailed Summary of Bad Order Cars On Hand and Repaired Each Day.—Information Obtained from Telegraphic Report Shown in Fig. 6

information is obtained, immediate and definite action generally results.

TRANSFER OF LOADS

On this particular road the car department handles all of the transferring of bad order equipment and there is therefore less liability of unnecessary transferring of loads on account of the fact that the car department men will make repairs under load if at all possible and it not only avoids a delay to the shipment, but increases the available supply of cars. At a number of points where it is necessary to transfer coal or grain, transfer tracks have been depressed so that the load from the defective car can be transferred to another car through a chute, thus eliminating the necessity of shoveling it. At Milwaukee this depressed track has a

Form 676

Chicago, Milwaukee & St. Paul Railway Company

CAR DEPARTMENT

Station_____ Date_____

Car Foreman_____

List of Bad Order Cars on Hand at this Station this Date

CAR NO.	KIND	INITIALS	Date Marked Bad Order	Loaded or Empty	Contents and Destination	DEFECTS	LOCATION

NOTE.—Use symbol "L" to indicate loaded, and symbol "E" to indicate empty. This report should include cars actually on repair track, or in yards awaiting to go on repair track. "Contents and Destination" column to be filled in only for loaded cars. This report to be made up on the last day of each month and forwarded to the local operating official in charge of switching, carbon copy to be forwarded to the master car builder, Milwaukee shops.

Fig. 9—Report of Bad Order Cars On Hand at the Close of Each Month

capacity of four cars and such work is done in a very short time and with a minimum amount of damage to the equipment. Whenever transfers are made the car inspectors are required to take the seal records. While this creates additional work for them, it is felt that the point to record the fact of whether the seal was defective or not is at the point of the delivery of the car. Understanding the matter in this way, the men have co-operated in this and have done the work with great willingness.

A strong endeavor is made to instill in the mind of every employee a sense of responsibility and a special appeal has been made to the car inspectors. They are now required to place triangles on the end of every car they inspect, showing their number, the station symbol and the date. This appears on both sides of the car at one end and in case of a wreck the car inspector whose mark appears on the car is called into the investigation. Thus the organization is such that direct responsibility can be placed without difficulty.

RUNNING INSPECTION

Special arrangements have been made at certain points on the system which have improved the handling of trains over the line. For instance, at Omaha freight trains are held for a sufficient length of time to make all necessary repairs. On a train of 75 cars probably 10 or 16 men would be required to make the inspection and the repairs, two men starting from the front and two from the rear. When they meet at the center, two climb up on the cars and inspect the roofs, the other two covering the train with the repair men and seeing that all the necessary work is accomplished. By doing this it is not necessary to hold the trains for intermediate inspection between Omaha and Chicago, a distance of 488 miles.

It has been found possible also to make repairs to cars while they are waiting to be unloaded. This applies particularly to the cars handling ore on the Superior division. As they are waiting to be unloaded at the docks the equipment is inspected and repaired so that as soon as they are unloaded they can go back to the mines in solid trains. This has been found to save considerable time and has worked out admirably since it has been put into operation.

At Milwaukee, all steel passenger trains bound for the coast are thoroughly inspected. All the journal boxes are carefully examined and brasses and wheels are changed if they will not withstand the service from Milwaukee to the point of destination at Seattle or Tacoma. While this means several hours' delay, it has permitted the road to move its trains in units without difficulty and intermediate delay. Reports are frequently received for the entire system showing no passenger train delays due to the car equipment.

STANDARD MAINTENANCE INSTRUCTIONS

One important feature in obtaining proper maintenance of the cars, has been the complete set of instructions sent out in printed form, known as the car maintenance regulations. As an example, car maintenance regulation No. 200-1, covering the maintenance of freight car roofs is given below, which gives an idea of the extensive and complete instructions given.

MAINTENANCE OF FREIGHT CAR ROOFS

Car foremen will be held individually responsible for the enforcement of these instructions, and are to notify the master car builder in case any condition arises wherein they find it impractical or impossible to maintain the regulations set forth.

1—Roofs of all cars on repair tracks must be inspected, and if metal roofs or double board plastic roofs have outside boards loose, the loose nails must be drawn and boards renailed with two nails staggered in each board at each purline, side plate and ridge pole. In renailing care must be taken to use proper sized nails, so that metal roofing will not be punctured, correct size being 2¼ in. No. 8 barbed wire.

All nail holes left open after renailing are to be carefully and properly filled with "Sarco," "Bako," or other suitable ingredient to prevent leakage.

Where bolts are employed to hold roof structure or roofing in place, all bolts are to be tightened up through ridge pole, carlines, running board brackets, etc., and have nut locks or lock nuts applied to prevent structure from again becoming loose. Where suitable means are not available for holding the nuts in place, either through lack of material or nature of repairs, cut the threads of bolt with chisel to prevent nuts coming off.

2—When metal roofs are damaged in wrecks, care must be taken to save all metal parts that can be used from cars destroyed. When cars are not destroyed, all parts must be placed in the car to which they belong.

3—When cars damaged in wrecks are to be burned, serviceable metal roofs or parts must first be removed.

4—When condemned cars are to be burned or torn down, serviceable metal roofs or parts of same must be carefully removed and kept for further use.

5—Wooden running board saddles must be secured to ridge pole by two 4½ in. No. 18 screws and at the ends by two 4½ in. No. 18 screws.

6—Running boards when loose must be secured in place by 2½ in. No. 16 screws, two per board at each crossing.

7—In addition to the repair track inspection and running inspection, the inspection at terminals must include the roof, with handholds, brake shafts and attachments, brake step, etc., and at points where there are shops, and it can be so arranged, men should be regularly assigned to renail roofs and secure running boards and saddles and fasten roof handholds in freight car yards.

8—All roof handholds must be tested by hand or with bar when on repair track, and if not perfectly secure, they must be refastened and secured by bolts through solid wood.

9—*Running Boards.*—There shall be one longitudinal running board. On outside metal or all metal roof cars there shall be two latitudinal extensions.

Longitudinal running boards shall be not less than 18 in., preferably 20 in., in width.

Latitudinal extensions shall be not less than 24 in. in width.

Running boards are to be located full length of car, center of roof.

On outside metal roof cars there shall be two latitudinal extensions from longitudinal running board to ladder location, except on refrigerator cars, where such latitudinal extensions cannot be applied on account of ice hatches.

Running boards are to be continuous from end to end and not cut out or hinged at any point; provided, that the length and width of running boards may be made up of a number of pieces securely fastened to saddle blocks with bolts or screws. The ends of longitudinal running boards shall be not less than 6, nor more than 10 in. from a vertical plane, parallel with end of car and passing through inside face of knuckle when closed with coupler horn against the buffer block or end sill, and if more than four inches from the edge of the roof of the car, shall be securely supported their full width by substantial metal braces.

Running boards shall be made of wood and securely fastened to car by bolts or screws.

The subject of loss and damage due to defective equipment is also given very careful consideration. Frequently statements are made showing the number of claims made in each district for certain periods of time as between system and foreign cars, the total amount of damage, the average cost per claim and the average number of defective cars per day. The matter is simply put out for the information of the various district general foremen and gives a comparison of the various districts. It gives the men an idea as to the extent of the damages occurring in their district and just what it means in dollars and cents, giving them an incentive to improve conditions.

The car department has in its organization a traveling air brake instructor whose sole duty is to follow up the air brake work on both freight and passenger cars. There are two instructors who look after the accounting office systems for the various repair points and shops with the idea of unifying and standardizing this work all over the road. The billing repair cards are made out in the office of the general car foreman and not at the small repair points. It has been found that this results in considerable saving and the records are easily obtained.

Every effort is made to keep the premises around all repair points as neat as possible and the company has even gone so far as to discharge men who persist in neglecting this matter, as it is believed that if the premises present a neat appearance greater efficiency will be obtained.

STANDARDIZING PAINTING AND STENCILING

BY J. H. PITARD
Foreman Painter, Mobile & Ohio, Whistler, Ala.

Since the railroads have come under government control and their operation conducted on the unit plan many advantages are gained by the changes being made in the various methods of operation. Some of the changes to a minor extent have reached the painting end of the freight repair yard, but thus far these changes in their broader scope and possibilities for effecting economy in the painting and stenciling of freight equipment are practically untouched. This implies the advisability of adopting a standardized system of painting and stenciling all cars under government control, regardless of previous practice in this particular.

To maintain the individual coloring and marking of cars of the various roads passing through the various freight yards where they are now required by federal order to be repainted and stenciled as conditions require, would result in an enormous increase in the amount of stencil making and stenciling with probable detention of cars, to say nothing of the costly increase in the variety and quantity of paint material necessary to be carried in stock in order to meet the emergency conditions.

The item of stencil cutting alone can well be imagined when it is considered that no two roads of the country have identically the same markings and many roads, strange to say, have no standard for stenciling their own cars, and yet such cars must frequently be repainted and stenciled in foreign yards whenever repairs or the perished condition of the paint renders it necessary to do so. When an unusual number of such cars appears in the repair yard simultaneously, it will in many instances probably result in the detention of such cars until the stencil cutting can be completed, unless there is a considerable increase in the stencil cutting force, which in either case means an increase in the cost of handling the situation that might be obviated by the adoption of a standardized plan of procedure.

Proceeding on the standardized plan, the original name of all roads could be maintained with lettering of the same style and size, likewise a smaller letter for expressing the equipments, dimensions, capacity, etc. Next, but not least in importance is the necessity for standardizing the color for freight equipment. At present the colors used are legion and while no particular color has any calculable superior commercial or advertising value, they represent an increased cost at the various freight yards on account of the constant matching of colors, changing of brushes and outfits from one color to another. For a standard color for freight cars there is perhaps none that would give better general satisfaction than the iron oxide, or so-called mineral brown very generally used by the roads of the country. It is not monopolized and is to be found in various sections of the country.

There is, however, one exception that should be made in standardizing on a freight car color and that is in the case of painting all refrigerator cars. For that purpose a very light color should be selected, as it is a well known fact that very light colors are the coolest for the physical reason that such colors reflect the heat, whereas very dark colors absorb it.

Of course it is difficult to even approximate the amount to be saved under a standardized plan of painting and stenciling all cars under federal control, but when it is considered how much it would simplify and expedite the operation, it is reasonable to suppose that the result would fully justify the change.

CAR DEPARTMENT ORDERS

During the past month the following orders were issued by the Railroad Administration relating to car maintenance problems:

MAINTENANCE OF AIR BRAKES ON FREIGHT CARS

In Order 99 the Southwestern regional director states that the general condition of air brakes on freight cars is such as to require immediate and continued careful attention. The following instructions are effective at once:

1. After the air brakes are cleaned and tested the air pipe should be properly fastened in place to prevent the rattling and breaking of joints and all leaks made tight.
2. Trains made up in transportation yards should have the brakes tested and all leaks remedied before departure. This should also be done on all cars passing over shop tracks.
3. Railroads should endeavor to clean, test and put in good condition, all automatic brake equipment on freight cars. The number of brakes thus repaired each month should be equal to at least one-tenth of the equipment owned by that road.
4. Federal managers should see to it that a record is maintained by the mechanical department to show the amount of this work that is done, and be prepared to make complete reports to the office of the regional director upon request.

CARE OF JOURNAL BOXES

The Mechanical Department has issued Circular No. 4 as follows:

1. It is desired that all freight car journal boxes be repacked with properly prepared packing at least once every 12 months, at which time all packing will be removed from the boxes and the boxes cleaned; dust guards to be renewed when wheels are changed.
2. The date and place where the work is done must be stenciled on the car body in one-inch figures and letters, using the same station initial that is used for air brake stencil.
3. This work to be done as far as possible when cars are on repair track undergoing heavy repairs. When on repair track for heavy repairs, cars which have not had boxes repacked within nine months will have all boxes repacked and the record stenciled on the car as above.
4. This does not contemplate any change in the intermediate packing of boxes when it is necessary to do so. No change should be made in the stenciling unless all boxes are repacked.

SHOP PRACTICE

LOCOMOTIVE SUPERHEATER MAINTENANCE*

A superheater is as strong or as serviceable as its weakest unit. A poorly ground ball joint, or a pipe repaired with a piece of butt-welded tubing, is only as durable as the imperfect repair job. Repairs of which these are illustrations are frequently the cause of serious and extended annoyance from equipment in service. There are correct methods of maintenance and they are always cheapest in the long run.

After a unit is completely assembled at the factory the ball ends are carefully ground so that a bearing from 1/32 in. to 3/32 in. wide is obtained entirely around the ball to insure a tight joint when it seats in the header. The ends of the unit

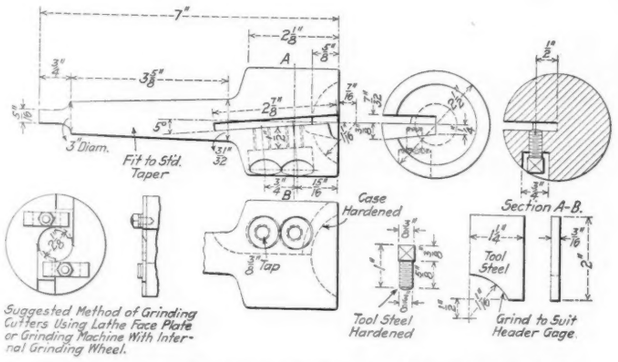


Fig. 1—Tool for Facing the Ball Ends of Superheater Units

are then protected by a wooden block, bolted in place. When a superheater has to be removed from a locomotive during repairs the unit ends should be protected by blocks in this manner, as otherwise the seats will be damaged. This will necessitate more work in order to get a satisfactory finish on the ball end. In refacing the seats on the unit ends, care should be taken to retain the spherical shape with a radius of 1-1/16 in. Great care should be exercised not to remove too much metal when truing up the seats. Unless a unit has been damaged so that it is grooved or cut, there is no need of finishing the end with a cutting tool as a light grinding is usually sufficient. The Draper cutting tool with the offset shank should not be used for this work, as in the hands of the average man it almost invariably results in destroying the spherical contour of the seat and there is consequently an imperfect joint made with the seat in the header. A satisfactory tool for this work is shown in Fig. 1.

The seat in the header for the ball end of the unit is not made spherical, but is a bevel seat with an angle of 45 deg., and can be trued up by means of a 45 deg. reamer, Fig. 2. Here, again, it is seldom necessary to take more than a very light cut. Great care should be exercised when the reamer is used with an air motor to prevent damage by reaming the seat too much.

For obtaining the final line bearing on both the unit end and the header, the most satisfactory method is the soft-metal grinding process. This process is both simple and cheap. A grinding cup of lead or hard babbitt metal is used for the unit end and a ball 2⅛ in. in diameter, and of the same metal, for the seat in the header. These are used with powdered carborundum to obtain the line bearing, and when the cups and balls commence to lose their contour they can be melted and used over again. The mold for forming the cups and spheres is shown in Fig. 3. It consists of three parts—the base in which the cup grinder is cast, the base in which the spherical grinder is cast, and the top part of the mold which may be used with either base. A chuck is shown in Fig. 4 which will hold either the cup or the spherical grinder, the chuck having a shank suitable for use in an air motor.

The use of these molds renders practical the production, at a nominal cost, of grinding forms which are accurate in contour, by all terminals regardless of their mechanical equipment. There is practically no waste of material as the material can be used repeatedly.

Excessive grinding will not produce a seat that will

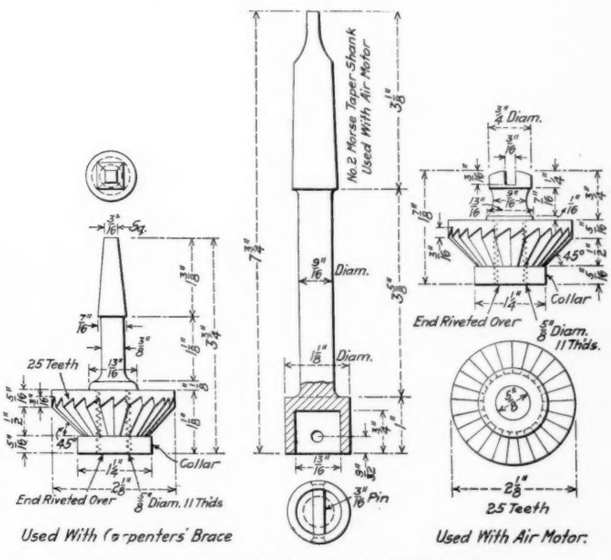


Fig. 2—Reamers for Superheater Header Seats

make a tight joint, but will only result in wearing the seat out of true. A light grinding that will produce a good line bearing, from 1/32 in. to 3/32 in. wide is sufficient.

LEAKING UNIT JOINTS

Leaking unit joints at the header should be stopped by tightening the clamp bolt nuts, *taking care not to stretch the bolts.* If this will not tighten the joint, remove the nuts on the clamp bolt, drop the clamp and slide the unit out so as to get at the joints. If the seats are not badly cut, clean the joints and grind with the soft metal grinding tools.

It is recommended that both parts of the joints, when

*Taken from Bulletin No. 4 (Copyright, 1918) of the Locomotive Superheater Company.

finished, be tested with a gage having convex and concave surfaces, of 1-1/16 in. radius, before replacing the unit. Prussian blue should be used for this test, as it is finer than the red lead or lamp black ordinarily used and will show defects in the joints more plainly.

The ball part of the joint should show a continuous blue surface over the ball when tested with the concave seat in the test gage. The conical seat in the header should show a

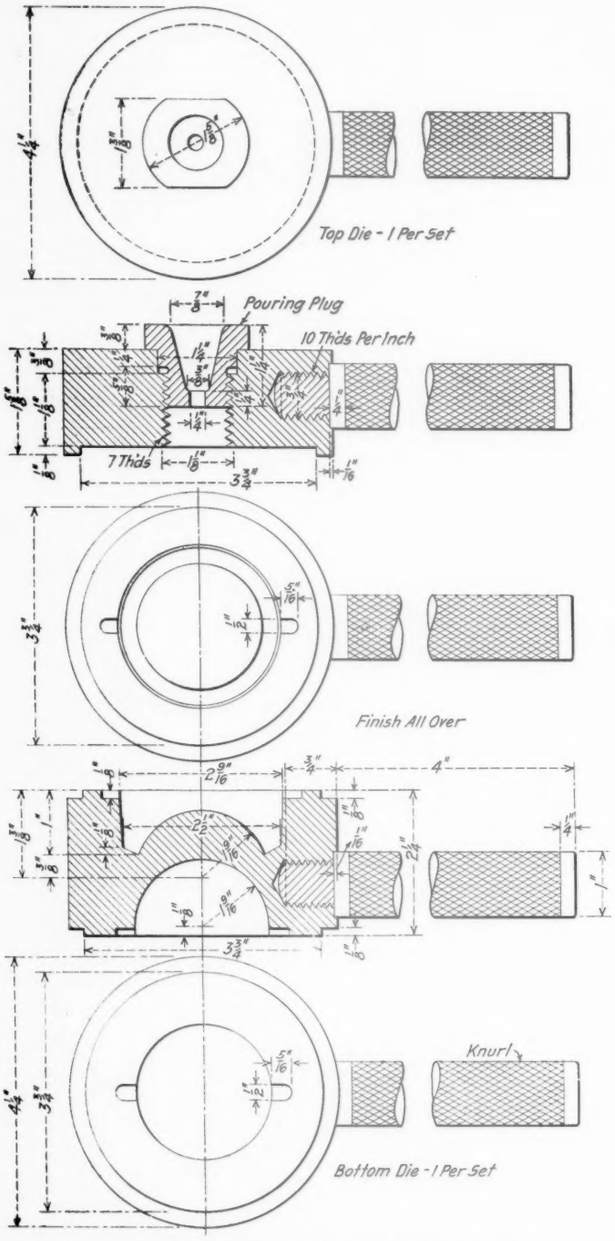


Fig. 3—Mold and Holder for Soft Metal Grinders

continuous blue line when it is tested with the ball end of the gage.

Ball joints in seats which have been damaged by steam cuts or mechanical injury should be brought back to the standard of new work, i.e., a 45 deg. bevel seat in the header, and a spherical surface of 1-1/16 in. radius for the ball end on the unit.

Varnish, red lead, plumbago, or other compounds, should not be used on unit ends or header seats in making joints. If the work of grinding is properly done their use will not be necessary.

TESTING

After all the units are in place, but before the second unit bolt nut or the steam pipes are applied, blank the steam pipe connections on the header and apply water test, to include the boiler, with a pressure at or above the working pressure of the boiler. Inspect all connections and stop all leaks that may appear. After the boiler has been steamed up, test the superheater with steam and try to tighten all the unit bolt nuts, after which the second nuts may be applied and set up tight.

For good service, *all* unit bolts should be gone over after

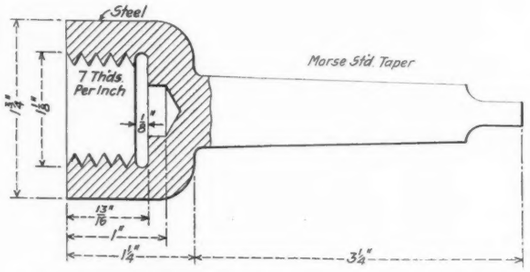


Fig. 4—Chuck for Holding the Cup or Spherical Grinder

the engine has made two or three trips, and any slack that may have developed in the bolts taken up.

BOLTS, WASHERS AND CLAMPS

The clamps and washers which, with the unit clamp bolts, hold the units in place against the header, are made of steel, and cast iron or other substitutes should never be used. In order to prevent the stretching of unit clamp bolts, and consequent leaking of the joints at the header, these bolts are made of heat-treated steel with a tensile strength of

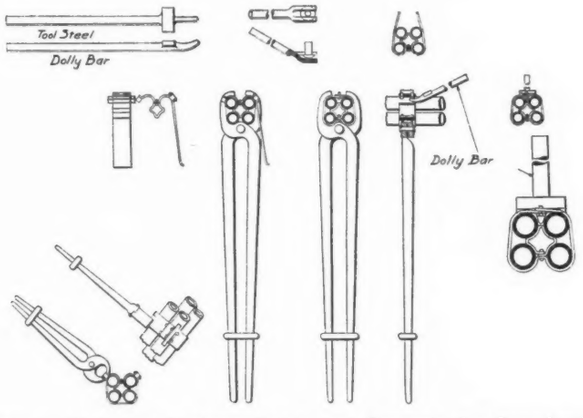


Fig. 5—Tools for Applying Bands and Supports for Superheater Unit Pipes

100,000 lb. per sq. in. and an elastic limit of 75,000 lb. per sq. in. Ordinary bolts, of low tensile strength, are not satisfactory for this work.

UNIT PROTECTING SHIELDS

The cinders formed by the coal in use in some localities have a cutting action on the upturned ends of the unit pipes in the smokebox. This wear, if allowed to continue, may cause holes in the pipe. Where such wear takes place it can be guarded against by applying shields. The shields for the pipes are formed of 1/16 in. steel and are held in place by bending them around the unit pipes.

MAINTAINING BANDS AND SUPPORTS

If the unit pipes are not held in place so that they will always maintain the same position in relation to each other and the flue, the unit will vibrate in the flue, not only causing wear on the flue and the unit, but also tending to break the joint between the unit pipe and the header and permit steam to escape into the smokebox. The bands and supports, therefore, should always be carefully applied whenever it is necessary to do so in the course of making repairs. Confusion sometimes exists as to the difference between bands and supports. The bands are provided with a center filling or spacing piece for the four unit pipes, and the band proper is riveted to this and finally the two ends are riveted together around the pipes. The supports, while acting as bands, have in addition two pieces of square cross section, which rest on the flue and support the unit. These pieces should be slightly rounded on the ends to prevent their cutting into the flue during expansion and contraction.

For units less than 136 in. long, one support is required for each unit. For units over 136 in. long two or more supports are required for each unit. One band is required for each unit, in addition to the supports. The tools and method of applying bands and supports are shown in Fig. 5.

The proper application of bands and supports is of the utmost importance. The pipes should be firmly held together at all times and unless the bands and supports are properly applied, the pipes will vibrate in the flue. Furthermore, if bands are used where supports should be, the unit will rest on the flue so that the bottom pipes will not have the proper contact with the hot gases and the cinders and soot will have much greater opportunity to collect and block the flue, with the consequent impairing of the superheater's efficiency. In welding superheater flues, care is needed to prevent a reduction of the internal diameter as this may make it impossible to insert the superheater unit in the flue after the bands and supports are applied.

INTERPRETATION OF ORDER INCREASING WAGES OF SHOP EMPLOYEES

Director General McAdoo has issued the following interpretation No. 3 to General Order No. 27, and to Supplement No. 4, Addenda Nos. 1 and 2, Interpretation No. 1 and Amendment No. 1 thereto:

METHOD OF APPLYING INCREASES TO PIECEWORKERS.

ARTICLE I.

(*a*) The increases provided for in General Order No. 27 apply to each hour worked and not to piecework prices per item or operation.

(*b*) Overtime hours, prior to August 1, 1918, will be paid for at the rate in effect as of December 31, 1917, and up to and including July 31, 1918; from August 1, 1918, at the rate of one and one-half times the average straight time hourly piecework earnings for the current pay period, provided that the straight time piecework earnings plus one-half additional equals the guaranteed minimum at the hourly rate of one and one-half time.

(*c*) Any increase in wages due to increased rates of compensation granted between January 1, 1916, and December 31, 1917, shall be deducted from the amount of increase provided for in General Order No. 27, but in no case shall such deduction operate to reduce earnings based on rates in effect as of December 31, 1917.

(*d*) In the absence of established standard hourly rates for any one or more of the seven classifications designated in Supplement No. 4, the going rate in each craft in accordance with the classification existing prior to the application of Supplement No. 4 for mechanics or helpers at each point on each of the several railroads, shall be used as the base rate to which will be added the increases provided for in Section C, Article II, General Order No. 27.

(*e*) *Example* 1.—Assume that in Yard B, 75 wood freight car builders or repairers are employed, the base hourly rates in December, 1915, were:

15 at 32 cents per hour.
31 at 33 cents per hour.
17 at 34½ cents per hour.
12 at 36 cents per hour.

Thirty-three cents thus becomes the going rate for the basis of computing the hourly increase for all wood freight car builders or repairers in Yard B. General Order No. 27, Article II, Section C, using the going rate of 33 cents, establishes a rate of 46.75 or 13.75 cents increase over the December, 1915, hourly rate. Between January 1, 1916, and December 31, 1917, increases amounting to 9 cents per hour had been put into effect. The net increase established by General Order No. 27 is therefore 4.75 cents per hour to hourly workers, and represents the total increase per hour to pieceworkers of the same class in Yard B. The same method of procedure will apply to each of the respective groups of employees, such as upholsterers, coach carpenters, cabinetmakers, passenger or freight steel car body builders or repairers, truck builders or repairers, coach painters, locomotive painters, locomotive carpenters, molders, coremakers, electricians, signal men and signal maintainers, tinners, pipe fitters, coppersmiths, sheet metal workers, and all men classified and used as helpers.

(*f*) Where piecework rates or pieceworkers received no increase between January 1, 1916, and December 31, 1917, it is evident that the average earning rate was sufficiently in excess of the hourly rate to cover any increases that may have been granted hourly workers. In determining the increase to such pieceworkers, they shall receive the same increase per hour as accrues to the hourly worker under General Order No. 27, illustrated herein by example 1, paragraph *e*.

(*g*) The application of increases to machinists, boilermarkers and blacksmiths, who are on the piecework basis, shall be as above outlined (see example 2) except where the establishment of the minimum rate of 55 cents per hour is less than the increase provided for in Section C, Article II, General Order No. 27, in which case the greater increase will apply. (See example 3.)

(*h*) *Example* 2.—In December, 1915, machinists in Shop C were paid a going rate of 35 cents per hour. Section C, Article II, General Order No. 27, establishes a rate of 49.50 cents per hour. This would automatically go to the minimum rate of 55 cents per hour, or 20 cents increase over the December, 1915, hourly rate. Between January 1, 1916, and December 31, 1917, increases amounting to 9 cents per hour had been put into effect. The net increase established by General Order No. 27 is therefore 11 cents per hour to hourly workers and represents the total increase per hour to the machinists on piecework in Shop C.

(*i*) *Example* 3.—In December, 1915, machinists in Shop D were paid a going rate of 42 cents per hour. The new rate provided for in Section C, Article II of General Order No. 27, is 58.25 cents per hour, making an increase of 16.25 cents per hour over the December, 1915, hourly rate. Between January 1, 1916, and December 31, 1917, increases amounting to 9 cents per hour had been put into effect. The net increase established by General Order No. 27 is therefore 7.25 cents per hour to hourly workers, and represents the total increase per hour to the machinists on piecework in Shop D.

(*j*) If the increases for pieceworkers under General Order No. 27, added to their average hourly straight time piecework earnings, by pay period, do not equal the minimum hourly rates established for hourly workers of the same class, the back pay due such pieceworkers, by pay periods, January 1, 1918, to July 31, 1918, inclusive, will be computed on the basis of the minimum hourly rates applicable to the respective classes, as per Supplement No. 4.

(*l*) *Example* 5.—Pieceworker F, guaranteed a 58 cent minimum hourly rate by Supplement 4, worked 208 straight time hours in March, 1918; his average piecework earnings for this pay period were 55 cents per hour, including the increase under General Order No. 27. Pieceworker E therefore receives the minimum rate of 58 cents per hour for the March pay period.

(*l*) *Example* 5.—Pieceworker F, guaranteed a 58 cents minimum hourly rate by Supplement 4, worked 208 straight time hours in March, 1918; his average piecework earnings for this pay period equals 60 cents per hour, including the increase under General Order No. 27. Pieceworker F, having exceeded the minimum rate of 58 cents per hour for the March pay period, receives back pay at the 60 cent rate.

(*m*) *Example* 6.—Pieceworker G, guaranteed a 58 cent minimum hourly rate by Supplement 4, worked a total of 268 hours in August, 1918, divided as follows: 50 straight time hours on hourly work at 58 cent rate, 158 straight time hours on piecework, average earnings per hour 65 cents, 20 hours overtime on hourly work at the rate of one and one-half time, or 58 plus 29, equaling 87 cents per hour, and 40 hours overtime on piecework, or 65 plus 32.50, equaling 97.50 cents per hour (as per Art. II, Sec. A), the total earnings for the August pay period are as follows:

50 hours at 58 cents per hour	$ 29.00
158 hours at 65 cents per hour	102.70
20 hours at 87 cents per hour	17.40
40 hours at 97.50 cents per hour	39.00
Total	$188.10

GENERAL APPLICATION OF INCREASES, SUPPLEMENT 4 TO GENERAL ORDER 27.

ARTICLE II.

(*a*) The increases provided for in Supplement No. 4 to General Order No. 27 apply only to hourly, daily, weekly or monthly rates, with the proviso that in no case shall a piecework be compensated for service rendered from January 1, 1918, to July 31, 1918, or thereafter, at a less rate per hour, for each straight time hour worked, than the minimum rate established for the hourly worker as per the respective classifications. Effective August 1, 1918, the one and one-half time rate overtime applies to pieceworkers as well as to hourly rated employees.

(*b*) Increase provided for in General Order No. 27 for hourly, daily, weekly and monthly paid employees, were cancelled with the issuance of Supplement No. 4, and in no manner refer to or affect the increases provided for in Supplement No. 4 to General Order No. 27.

(*c*) The hours of service and overtime provisions of Supplement 4, Article IV, Section 2, do not apply to supervisory forces on monthly salary, referred to in Supplement 4, Article III, Section 5.

(*d*) Monthly supervisory forces specified in Supplement 4, Article III, Section 5, assigned to inspect new equipment under construction by contract, shall receive the salary increase of $40 per month.

(*e*) Excepting salaried supervisory forces and coach cleaners, employees coming within the classifications specified in Supplement No. 4 to General

Order No. 27, shall be paid for overtime as provided in Section 2, Article IV, of Supplement No. 4.

(*f*) Employees voluntarily leaving the service.—The amount accruing under the provisions of Supplement 4 to General Order No. 27 will not accrue to those employees who left the service voluntarily to accept or secure employment at some other point on the same railroad or on another railroad, or elsewhere, because remaining in the service at the point employed, unless transferred, was the consideration upon which the promise to make the increases effective as of January 1, 1918, was based.

ARTICLE III.

RATES BASED UPON YEARS OF EXPERIENCE.

Supplement No. 4, Article II, Sections 2, 2-A and 2-B.

(*a*) Employees performing work recognized as mechanics' work in the respective trades, who by agreement with duly authorized committees representing the craft or crafts, have had their rates leveled up to that of the mechanic, shall receive the mechanics' rate as per Article II, Sections 1 and 1-A; otherwise Article II, Sections 2, 2-A and 2-B will apply. The period of experience on mechanics' work, in the trade employed, shall be cumulative.

Example 7.—Employee H worked:

12 months on machinist's work for Railroad C.
6 months on machinist's work in navy yards D.
12 months on machinist's work in manufacturing plant E.
18 months on machinist's work for railroad by whom now employed.

Total, 4 years.

Such employees should be paid the machinists' rate.

(*b*) Nothing in the above section shall be construed to mean that mechanics of the respective trades who have qualified as such in other industries, shall be paid less than the minimum rates specified in Article II, Sections 1 and 1-A of Supplement No. 4, upon entering railroad service.

ARTICLE IV.

EXPENSE ALLOWANCE.

Sections 4 and 5, Article IV, Sup. No. 4 to General Order No. 27.

The allowance for expenses provided for in Section 4, Supplement No. 4 to General Order No. 27, is the same as shown in Section 5, and is at the rate of $2 per day for three meals and lodging; 50 cents per meal, 50 cents for lodging. It is not intended to make this feature retroactive prior to August 1, 1918.

ARTICLE V.

SUPERVISORY FORCES.

Section 4, Article III, Supplement 4 to General Order 27.

This section applies to minor supervisory forces who are held responsible for the work of their gang, have been so recognized, and who shall receive 5 cents per hour in excess of the minimum hourly rate established for the craft.

ARTICLE VI.

WHEEL SHOP EMPLOYEES.

General Order 27, Supplement 4, Article I, Section 1 and 1-B.

(*a*) Employees boring and turning wheels, and turning axles in wheel shop, are classified as machinists by Section 1, Article I, of Supplement No. 4 to General Order No. 27.

(*b*) Employees pressing on and off wheels are classified as machinists' helpers by Section 1-B, Article I of Supplement No. 4 to General Order No. 27, and receive an increase of 13 cents per hour over rate in effect January 1, 1918, prior to application of General Order No. 27, with a minimum guaranteed rate of 45 cents per hour.

ARTICLE VII.

FLUE WORK.

Supplement No. 4, Article I, Section 2 and 2-B.

(*a*) Flue work, boiler department, includes flue welders under boiler foremen.

(*b*) Heaters and helpers assisting welders shall be classed as boilermaker helpers.

ARTICLE VIII.

RIVET HEATERS.

(*a*) Include rivet heaters in Supplement No. 4, Article I, Section 2-B. Rivet heaters under 18 years of age shall be paid 25 cents per hour until they reach the age of 18, and thereafter helpers' rates.

(*b*) Rivet heaters in Supplement No. 4, Article I, Section 6-B, under 18 years of age shall be paid 25 cents per hour until they reach the age of 18, and thereafter helpers' rates.

ARTICLE IX.

ELECTRICAL WORKERS.

Supplement No. 4, Article I, Section 5 and 5-A.

It is not necessary for an electrical worker to be competent to perform all items of work specified. Employees skilled in any of this work shall be paid the rate established for the respective class.

ARTICLE X.

MATERIAL CARRIERS AND HELPERS.

(*a*) Material carriers in Supplement No. 4, Article I, Section 6-B, applies only to employees regularly engaged in selecting and distributing material to mechanics in car department.

(*b*) Laborers shall not be classified as helpers in the seven basic trades, unless they actually perform work recognized as helpers' work.

ARTICLE XI.

LOCOMOTIVE CRANE OPERATORS.

Section 6, Article I, Supplement No. 4 to General Order No. 27.

Locomotive crane operators, when employed in the car and locomotive shop yards, shall be considered under the same classification as "wrecking derrick engineer" in Section 6, Article I, Supplement No. 4 to General Order No. 27, and receive 13 cents per hour over the rate in effect January 1, 1918, prior to the application of General Order No. 27, with a guaranteed minimum of 58 cents per hour. (Where employed in other departments they shall be considered under the same classification as pile drivers, ditching and hoisting engineers, in Article I, Section b of Supplement No. 8 to General Order No. 27.)

ARTICLE XII.

DERRICK ENGINEER.

Section 6, Article I, Supplement No. 4 to General Order No. 27.

"Wrecking Derrick Engineer" covers the engineer operating a power-driven crane employed principally for clearing up wrecks.

ARTICLE XIII.

MOLDERS AND HELPERS—CUPOLA TENDERS.

Supplement No. 4, Article I, Sections 7 and 7-B.

(*a*) A cupola tender is interpreted to be one who supervises the cupola and prescribes the charge, the fuel to be used and drawing the melt.

(*b*) Cupola tender helpers shall receive an increase of 13 cents per hour over rates in effect as of January 1, 1918, prior to the application of General Order No. 27, with a guaranteed minimum rate of 45 cents per hour.

(*c*) Employees in charge of brass melting in foundry shall receive not less than the molder's minimum rate, and helpers the same as helpers in Section (*b*) of this Article.

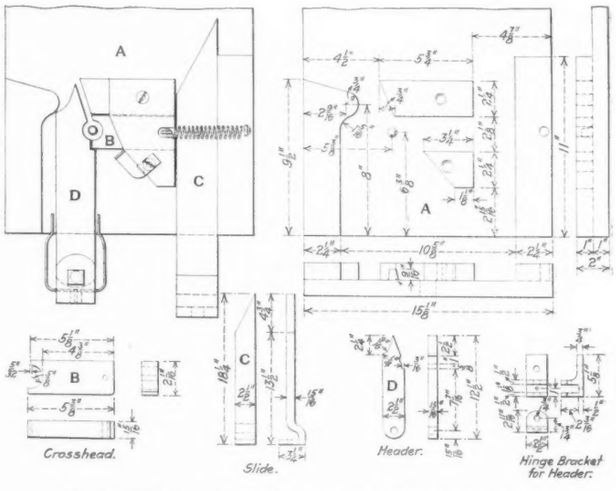
ARTICLE XIV.

These interpretations shall apply to all addenda, amendments, and interpretations to Supplement No. 4 to General Order No. 27, from their respective effective dates.

FORMING EYEBOLTS ON THE BULLDOZER

Large numbers of eyebolts, particularly of the smaller sizes, are used on freight cars. In making these the eyes are usually formed by hand. The Milwaukee shops of the Chicago, Milwaukee & St. Paul have developed a device for doing this work on the bulldozer which is illustrated below. It consists of a die *A*, which is fastened to the face plate of the machine, a crosshead *B*, fitting in the die, a slide *C*, and a header *D*. The slide and header are attached to the live head of the machine.

The device is assembled as shown at the left side of the accompanying drawing. To operate it the live head is moved



Die for Bending Eyebolts on a Bulldozer With Details

back, bringing the crosshead and the header away from the central pin in the die. The heated stock is next inserted between the crosshead and the pin and is brought up to the gage. The live head of the machine is then brought forward.

The slide first forces the crosshead in and the header then comes into play and bends the stock around the other side of the pin. A spiral spring is provided to return the crosshead and a flat spring keeps the header in position. This device can also be used with good success for bending hooks.

When the "Old Man" Showed His "Pep"

The Difference Between "New Blood" on Some Railways and "New Blood" in the Industrial Field

BY HARVEY DEWITT WOLCOMB

THE "Old Man" was on the war path. The news spread quickly through the shop by that indescribable method common to all shops where a large number of men are employed. It wasn't gossip, neither was it a thing of conversation—it was just a little warning to keep out of his path, for woe to the man who invited a call down when the "Old Man" was off temper. This particular morning, as he walked down through the shop with eyes straight to the front, looking neither to the right nor left, a stranger would have said that apparently he was not interested in what was going on. Entirely to the contrary, he was very much interested indeed, and while he did not as much as wink an eye, he did, however, take in all that was going on around him.

Dan Keefe—commonly spoken of behind his back as the "Old Man"—was a thorough mechanic educated in the hard school of practical experience. He had been master mechanic of the big terminal at Wonderly on the R. S. & P. for so many years that he knew every nail in the building. He was a good manager and had established many records that few shops of equal size could duplicate. This had not, however, turned his head, for he was one of the finest chaps in the world to visit, but when it came to business he was an entirely different man.

It had been some time since he had had a spell of being on the war path and as everything was going along smoothly, Jim Booth, the general foreman, was at a loss to know what had caused the present trouble. He was to be enlightened very shortly.

Going straight to his office, the "Old Man" sent the office boy out for the general foreman. You can imagine how poor Jim Booth felt. From past experience he knew he was to get the devil no matter whether he was in the wrong or not. Someone had to be the "goat," and on many previous occasions the general foreman had been that animal. But then, as this is part of the railroad routine, he made up his mind to take his medicine like a man.

Much to his surprise, when he entered the private office the master mechanic greeted him with a cheery "good morning." Pointing to a letter on his desk, he boastfully said, "Well, Jim, we beat them at their own game. You remember about a month ago the superintendent had two inspectors down here, and after they 'gum-shoed' all over the place the only thing they could criticise us about was the new store shed we built behind the roundhouse. The superintendent wrote me a nasty letter about that and as much as said if I couldn't satisfactorily explain why this shed was built, I might as well look for another job. That made me sore, for these two inspectors didn't know as much about the many little details of this place as a setting hen. They simply came down here a few days, skimmed over the surface and then made their report."

"We had authority for that shed," broke in Jim.

"Oh, yes," he replied, "proper authority had been granted to construct a shed and the M. of. W. department was to build it, but after waiting over a year for them to make up their mind we went ahead and built it ourselves. That's the only way you can accomplish anything on a railroad—do it yourself and you know it's done. But here is the joke of the whole thing. Those inspectors didn't know that that common looking shed was really a complete auxiliary power plant. You know, Jim, when we built that shed, we put in two concrete pits, connected up the sewer, ran a six-inch steam line through the building and tapped our main water supply line. Last winter when all the other plants were tied up for steam we simply ran two locomotives in that shed and in less than an hour we had a complete power plant in operation. Our men had protection from the severe weather, our engines did not freeze up, and everything was so conveniently arranged that it did not cost us much money to take care of the extra requirements. While the other fellows were running around trying to make temporary arrangements to furnish steam to take care of the extremely cold weather, I was wiring the superintendent that we had plenty of steam and everything was O. K. In other words, we had foresight."

"Yes, I know that deal last winter always did bother the superintendent. You remember, he cornered me one day down in the shop and asked me all about how we managed to come through so well, but I was ready for him and told him then just what you had advised me to say."

"You did just what was proper, and now, my boy, I want to tell you something. You have been general foreman for me here at Wonderly for nine years. I have held on to you and have refused to let you be transferred or promoted many different times, but I can see that my selfish motives were not fair to you, so am going to recommend you for the job as master mechanic at Johnson's Landing. They need a good man there and with your long training, I know you will make good."

Dumbfounded, poor Jim Booth didn't know what to say. He had been at Wonderly so long that the place seemed like home to him and away down in his heart it nearly made him sick to think of starting out anew. At Wonderly he knew every man, knew just how to handle them. His family had their friends, he held office in one or two of the lodges of which he was a member, and—to tell the truth—Jim Booth didn't welcome the thought of a change. But he knew the

THIS story, drawn from real life, carries a moral, the force of which will be apparent to many of our readers. Positions filled through nepotism or "a pull" are seldom, if ever, properly administered. There is no easier method of breaking up the esprit de corps than to disregard the value and the real worth of the men by sidetracking them for somebody's friends. Even the men in the ranks will buck such a procedure. There are hundreds of thoroughly seasoned men in the railway mechanical departments today who would make able and desirable supervising officers. Smoke them out—develop them—make the supervising positions attractive to them. Don't let the industrials get the cream. An able executive is as valuable to the railways as to any other industry.

"Old Man" thought a great deal of him and if he said "Go," then go it was.

This sudden and unexpected news of being promoted so excited Jim that he excused himself and returned to the shop. Although he said not a word to any one in the plant about the conversation, the news, however, quickly spread about the shop that something was in the air and it didn't take the men long to ferret out the fact that they were to lose their general foreman. And then the question arose—who was to be the next general foreman? From all indications Jack Donnely would be the lucky man, for he had always acted as general foreman when Mr. Booth was sick or laying off. Donnely was a good mechanic, a good manager of men, a good workman, steady and reliable. He was the sort of man who is a credit to any shop, and while he had been offered several good jobs at other shops, he had always refused to move. He was loyal to the heart and always would work his head off for Dan Keefe.

The "Old Man" respected his ability and thought a great deal of him, too, so naturally, when he wrote the superintendent that he was glad to have Jim Booth secure the position as master mechanic at Johnson's Landing, he took considerable pride in writing that he had a man well trained to fill the position of general foreman and gladly recommended Jack Donnely.

That is where he spilled the beans. The superintendent came right back and told him that he had thought for some time that Wonderly needed some "new blood" and that while he would like to respect his recommendations, he was, however, sending a young man as general foreman to Wonderly who, he thought, would be a better man. Down in the corner of the letter the superintendent had noted in his own handwriting, "Use this young man well, for he is a friend of one of our officials."

How the "Old Man" did rip and snort. He was like a wild man. He was mad enough to bite a ten-penny nail in two. He cussed everybody from the call boy up. And to ease his mind, he sat down and wrote the superintendent a letter that was a classic in sarcasm. Evidently his efforts were wasted, for he received no reply. One day about two weeks later a young man arrived at Wonderly with a letter, and introduced himself as the new general foreman.

Dan Keefe had sense enough not to say what he thought. However, he was furious to think that after his years of service the company would send a young man so inexperienced to handle a big shop like Wonderly. The young man frankly admitted that he had never handled men and, furthermore, he ventured the remark that that required no special training, anyway. He said that he was a close student of system and concentration and that he felt he could rapidly build up the output at Wonderly.

What could the "Old Man" do? His hands were practically tied. He realized that if this young man was a failure, he would be blamed for the whole thing, and the chances were that he would lose his job. The young man was entirely unfitted for the position, but he had a "pull." His future was assured, no matter what happened, but Dan Keefe, with his enviable record, would be cast aside as a has been. He saw that in addition to his already burdensome duties he would now have to watch many of the little details of the general foreman's job.

It was not a very pleasant outlook, but he had given the best years of his life to the railroad, and if he laid down now all his past efforts would be wasted and his only recourse would be that of going back to work at his trade as a machinist. This thought was not altogether to his liking, for he felt that the company should at least provide for his old age by placing him in some position where they could make good use of his years of experience. He had always stuck by the railroad through success and adversity; had been laid off when times were hard; had worked 18 hours a day when times were good and business rushing. He had suffered with the company, but had always come back smiling, ready to give them his best efforts. And now he was to be tied down with an assistant who knew practically nothing about the game, but who was assured of success by that never failing power of "a pull."

Well, the "Old Man," like all true railroad men, had to make the best of a bad bargain, so he started his new general foreman in with all the advice possible. He worked with him, watched the output, kept his eye on the supplies and did everything in his power to keep the plant going at top speed. But what a job! The new general foreman would do more damage in one day than he could straighten out in a week. For instance, it was soon noticed that many of the good workmen were absent. On investigation he found that the general foreman had the idea that discipline consisted of laying off a man for a week or ten days. The workmen quickly saw through the whole deal, and if a fellow wanted to lay off a week or ten days he would pull off some little trick so that the general foreman would lay him off. This practice got so bad that many of the best men were being laid off unjustly, and the shop output began to slow up. Maybe the "Old Man" didn't rave when he found this out. It took some strenuous efforts on his part to whip things into shape and what he told the general foreman was a-plenty.

Shortly after this he noticed that many of the foremen were not as punctual as usual. The general foreman had the idea that one's organization should run just as well when the leader was absent. He made no effort himself to reach the shop on time in the morning, took a much longer time off for lunch than was allowed and would go home at night whenever he felt like it. The foremen were all quick to note these new conditions and some took advantage of them. The result was that even the workmen slowed up, and the lessening of discipline reflected in decreased output. The "Old Man" now had another hard battle on his hands and it was only by the hardest kind of work that he succeeded in breaking up the practice.

Dan Keefe was at his wits' ends. He was thoroughly disgusted. The general foreman acted and talked that big "I" and little "you" stuff so much that he actually fooled himself into believing that he was making a success of running the place. Whenever any of the higher officials visited the shop you could always find him in the foreground doing all the talking and explaining. He couldn't be told a thing. Even when actual figures were given him showing an alarming increase in costs to handle the shop he would have some sort of an explanation ready. Not being a mechanic himself, the quality of the work began to fall off. The workmen became careless. Failures and breakdowns increased amazingly, and he would pass this off by saying that the quality of presentday workmen was much inferior to the old-time mechanic—and he had a shop full of good men; men who had made many good records prior to his taking charge of the place. The workmen began to quit, and it kept the "Old Man" on the jump trying to hold them. Only by the force of his strong personality did he manage to get many of the fellows to stick.

Sick and disgusted, he was about ready to give up when one day he received a letter from a large manufacturing concern asking him to call at their main office. Bewildered at such a request, he answered the letter and said he would be there in two days.

Arriving at the office, he sent in his name and was at once taken to the office of the president of the concern.

"Mr. Keefe," said the president, "we are at a critical period in our career. Our output is not keeping pace with our demands. We have tried all sorts of schemes, but I am not satisfied with the results. We have had system men,

special trained men, office men and many other kinds of specialists look into our business, but they have all failed, in my estimation, for they have lacked knowledge and experience in handling men. The human element enters very largely into our output, and I would like to have you take charge of our entire plant at a salary of just twice what the railroad company is now paying you."

Taken completely off his guard Dan Keefe could only stammer, "I am too old to start in on a new job now. What you need is a young man full of 'pep.' "

"Is that so," replied the president. "We have just got rid of one of those young men. He nearly put us out of business, and the only thing now is to secure a man of your ability—a man who has 'pep' that is backed by years of experience and common sense. We have been watching you for some time. Lately we have secured some mighty good workmen from your shop, and when we question them about their training they all give you the credit and speak very highly of you."

"I have been with the railroad so long that I very much dislike to leave now and lose my chance for future promotion," he answered.

"Can you not see," said the president, "that you have no further chance for promotion? The fact that you have been at one place so long is conclusive proof that you will not be promoted. Many promotions have been made since you have been master mechanic, but they have always skipped you. you were too valuable a man in your present position to be moved. You are standing still—have been, in fact, for the past five or six years. Men with less ability than you have been promoted, for they have had pull or friends higher up. Come with us, and you will advance as our company advances. Working for us you will receive the full credit for your ability. No one can claim that you are only a tool—the output and shop costs will reflect your good management. I will say further that it is our policy to pay a bonus over the regular salary for output or lessened costs on a previously decided figure. Will you come?"

"Yes, I will take your offer," said Dan, "and believe me, I will show you that there is some 'pep' left the old man yet."

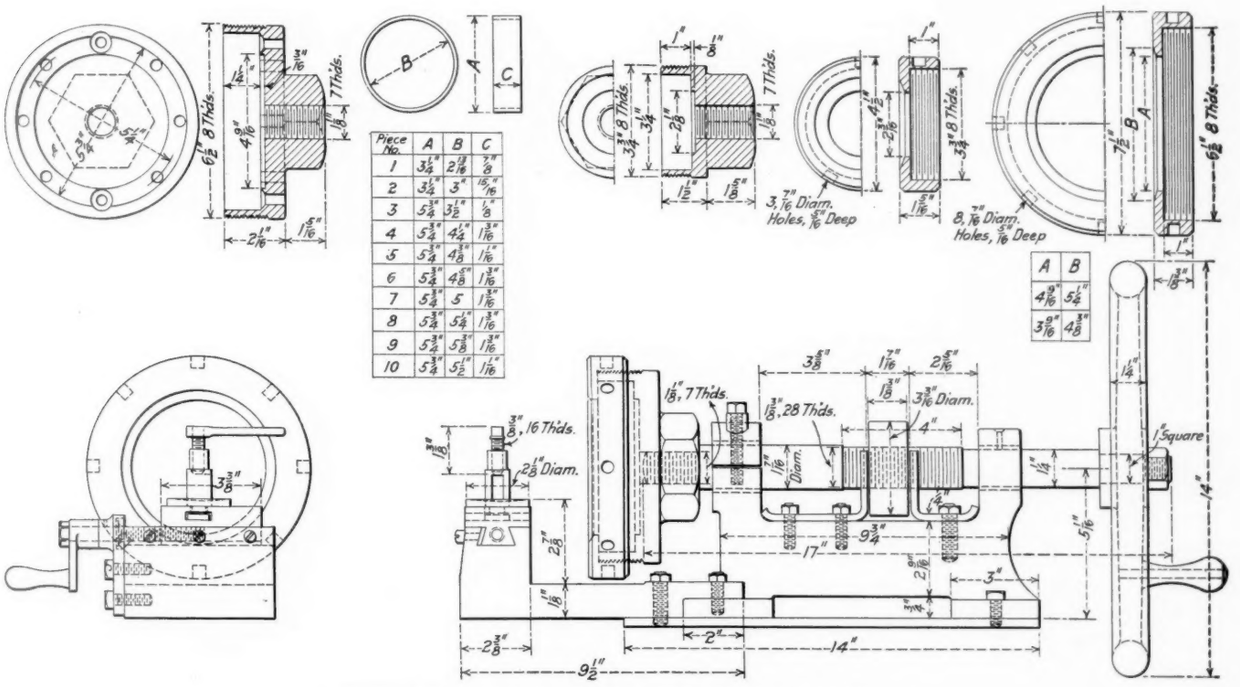
* * * * *

It was just one year since Dan Keefe had taken up his new duties as works manager of the large manufacturing plant. The president and board of directors were in session, and by special request the works manager, Dan Keefe, was present also.

"Gentlemen," said the president, addressing the board, "one year ago I told you that many a good man was buried on the railroads. Men who possessed wonderful ability were not always given proper credit. We secured Mr. Keefe as our works manager at a salary just twice what the road was paying him and also offered him the benefit of our bonus system. Gentlemen, he has earned every cent of his salary and, in addition, our output has increased to such an extent that I am now pleased to hand Mr. Keefe a substantial check in addition to his regular salary as a bonus for our increased output. I am proud to say Mr. Keefe has the kind of 'pep' that results in dividends and for which we as manufacturers are willing to pay."

HAND POWER LATHES FOR ROD PACKING

At roundhouses which are not equipped for turning up piston and valve rod packing it is necessary to keep in stock sets bored to many different sizes, which is costly and inconvenient. The device for turning packing rings illustrated below, which is in use on the Minneapolis, St. Paul & Sault Ste. Marie, will be found particularly valuable at such points. Its use is not confined to small terminals, however; where many engines are handled it will soon pay for itself by saving the time required to set up a lathe for the job.



Device for Boring Rod Packing with the Various Chucks

The device consists of a chuck for holding the packing, mounted on a spindle which runs in two bearings cast in the base. The spindle is turned by a handwheel. The base extends beyond the chuck and carries a toolpost on a slide

by which the tool is set for any desired size. The longitudinal feed is secured by a round nut on the spindle which is held between two stops in the base. By holding the nut while the spindle is revolved the chuck is fed in or out. The chuck shown is for Paxton-Mitchell packing, but it could readily be made to accommodate other forms.

THE DIFFICULTIES OF WELDING STEEL BY THE OXY-ACETYLENE PROCESS*

BY B. K. SMITH
Welding Engineer, United States Welding Company

The question of steel welding is one of the most important of all the problems which confront the oxy-acetylene welder. A large part of this problem has to do with his preliminary knowledge of steels and his primary habits of handling the blowpipe in steel welding. The steel weld in itself is apparently one of the most easy to obtain, so that some welders are considering steel welding as a subsidiary problem of their trade because their welds look so well; yet steel welding, notably in boiler work, requires the most thought and care, and should be studied not only from the practical point of view, but also theoretically. And what are the difficulties of steel welding? They are: (1) The incorporation of iron oxide; (2) the thermal disturbance in the vicinity of the weld, and (3) the expansion and contraction problems. Therefore one needs to study: (1) The properties of various steels; (2) the phenomena produced during the melting of the metal under the oxy-acetylene torch, and (3) boiler construction.

If one has the above knowledge in a sufficient degree, the welding in itself will be then comparatively easy and successful; but if he has not, and failures occur to him, he will insist that certain operations are impractical or impossible to perform with the oxy-acetylene blowpipe. This is one of the reasons why certain companies will not trust the apparently good looking welds, and reserve to themselves the right to sanction or forbid this kind of welding for boiler or pressure work.

In studying the incorporation of iron oxide in the weld, one must know what iron oxide is and what it looks like. Iron oxide is a burnt element, created on the surface of molten steel under the action of the blowpipe and the atmospheric oxygen. It appears as white veins and foaming spots. Iron oxide will dissolve into the molten steel at the rate of a little higher than one per cent, and in this reaction it may destroy the carbon elements with the result of a decrease in the strength and elasticity of the weld.

The best remedy to reduce oxidation is to reduce the oxygen pressure as low as possible; just enough to produce a free and soft flame that will produce a continuous melting without running over the edge. This operation depends largely on one's blowpipe and the flame maintained throughout the weld. With a proper flame, one will notice the flow of the metal clean and regular, but with a too rigid flame which requires more oxygen one will notice white veins and foamy spots flowing in the molten metal. These are streaks of oxide of iron, and they will dissolve and create new ones with the progress of the weld. The molten metal is swept rather than laid in clean layers, and in some cases the metal is adhered instead of welded. Oxide of iron cannot be altogether eliminated from any kind of weld so long as we cannot protect them from the effects of the atmosphere, but it can be so decreased from the interior of the weld that its contents would do no harm to the strength of the weld.

Some good and experienced welders who have been welding for five or six years, but who have met with some failures in steel welding, will not admit that the main cause of failure is the improper regulation of the flame because to do so would be the same as for a college student to be compelled to return to the grades to learn his A. B. C's. Most of our welders have previously mastered some other craft and have begun welding on important work without any preliminary instructions. In other words, they began at the college end without having acquired the necessary underlying primary and high school education.

What would a boilermaker think if a novice tried to put in a set of flues? Or a machinist if an apprentice attempted to make a set of dies? Yet the same boilermaker or machinist looks upon the welding blowpipe as merely a tool of his trade and thinks that all he needs to do it to go ahead and weld with it.

In studying the question of the thermal disturbance produced by the gas flame in the metal when it is raised to a fusing temperature we must not forget that it is heat which has led to the creation of many new steels, and while heat can be employed to increase the life of metals it can also reduce and destroy the life and strength of metals. Therefore, it remains for us to study carefully how we shall best make use of it.

It is a well known fact that the structure of any gas weld at the welding line, on a boiler plate, for instance, is cast metal. This metal is much lower in elongation than the boiler plate. Yet the structure of the boiler plate was originally at the mill a cast metal or something similar to the metal in the weld. But, it has been refined by the operations of heat and mechanical treatment to a strong metal that we call boiler plate. The question is this: Can we employ the heating agent with the aid of the gas blowpipe to refine the grain at the weld and its vicinity? My answer is, "Yes," provided the operator knows the physical and the chemical properties of boiler steel.

There is no more any such thing as not being able to take care of expansion and contraction in steel welding. But, in boiler welding, one will find this a problem which is difficult to solve unless he has a full knowledge of the construction of boilers.

The effects of expansion and contraction are little feared by some boiler welders because the metal to be welded possesses the property of elongation. My advice is that no welder should depend upon the metal giving, thinking that a little strain will not hurt the weld, for two reasons. The reason is that in almost all cases an intelligent welder can find a way to take care of the expansion and contraction. The second reason is that no human being can ever measure, or know how much of a strain he has left in the metal. It may be very little or it may be up to the breaking point. Such a weld may crack during its own progress or a few days after, or even six months after completion; at any rate the welder is not excusable and the failure will not only condemn the operator, but the process and the whole oxy-acetylene welding industry.

There is one point that an oxy-acetylene operator must bear in mind, and this is to make a strong weld. Economy should be considered as a secondary principle. While there must not be any useless waste in time or material, yet we must not forget that a defective weld is a waste of time and material.

*Abstract of a paper read before the Northwestern Welding Association, Minneapolis, Minn.

POPS WASTE FUEL.—To show how fuel is being wasted, A. Sutherby, master mechanic of the Erie Railroad at the Cleveland, Ohio, shops, has placed a coal box in the most conspicuous place in the shop, containing 90 lb. of coal. The box has a glass cover lettered to show that this amount of coal is wasted when the pop valve blows for six minutes. In 30 days this shop has saved four and one-half tons of coal by using refuse wood cut up in both of the sand stores, with good results.—*Erie Railroad Magazine.*

GRINDING IN LOCOMOTIVE SHOPS

The Uses to Which Internal, Cylindrical and Surface Grinding Machines May Be Put With Success

BY M. H. WILLIAMS

IT is now well recognized that grinding is the most approved method of finishing various surfaces—not only on account of the superior finish but also on account of the reduced cost. The distinctive forms of grinding machines now used to a more or less extent for railway work are the internal grinder, which is suitable for finishing various bearings in valve motion parts, side rods and other motion parts; the cylindrical grinder which is used for finishing round articles such as piston rods, valve rods, crosshead pins, etc., and now used quite extensively on piston rods; and the surface grinder, which is now used for finishing locomotive crosshead guides, the flat surfaces on main and side rods, etc. Some of the uses of these machines are explained below.

INTERNAL GRINDING MACHINES

This class of machine has great possibilities for railway use. It is possible by the use of this machine in some of its forms to grind the inner surfaces or holes of practically

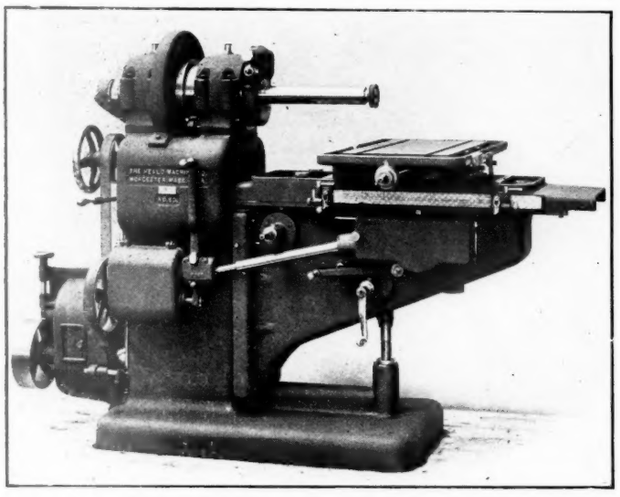


Fig. 1—A Typical Internal Grinding Machine That Has Rendered Valuable Service in Locomotive Shops

all bearings used on locomotives, the surfaces produced being much smoother and more cylindrical than those obtained by the customary turning, reaming or lapping methods. As a general practice, month in and month out, this method will be found economical, regardless of the degree of finish required, for the work can be done more quickly than by other methods and a better job will be performed, which means fewer renewals.

There are a number of forms of internal grinders and attachments on the market. One of the more common is the internal grinding attachment, used on universal or tool room grinding machines, and on which most excellent work may be done. These, however, lack the rigidity necessary for locomotive work where speed is essential.

Then there is the internal chucking grinding machines, on which the work is revolved similar to the method followed on the tool room grinders. They are rugged and will grind to the limit of the grinding wheels. This class of machine can be used for grinding the holes in bushings used in valve motion parts, knuckle pin bushings and similar work. In some of the larger railway shops this class of machine will be found useful, its use being limited to such parts as can be revolved while being ground.

For both new and repair railway work one of the most useful machines is the internal grinder, shown in Figs. 1 and 2, on which holes may be ground without revolving the work. With this class of machine the article to be ground is secured to the machine table as shown in Fig. 2. This table resembles in many respects a milling machine table and has very similar adjustments so that the work may be brought in line with the grinding wheel spindle. The grinding spindle *A* revolves similar to the ordinary grinder spindle. The bearings for this spindle are located in a cylinder *B* that rotates slowly in the machine headstock *C*. The bearing for the spindle *A* may be adjusted to run nearly true in the cylinder *B* or can be adjusted outward to a greater extent, when desired, by turning the nut *D*. This motion is somewhat difficult to understand until the machine has been examined; afterwards it will be found to be simple. It might be likened to a portable electric grinder mounted on the face plate of a lathe, the entire grinder revolving while grinding the work which is held to the carriage of the lathe, and means being provided for moving the grinder on the face plate to and from the center to conform to the size of the hole in the work.

Fig. 2 shows the internal grinder set up to grind a part of a valve gear. It will be noted that the grinding wheel bears against the right side of the hole. As the cylinder *B* revolves one-half turn, the wheel will bear against the left side, etc., thus making a circle touching all points of the circumference of the bushing to be ground. In practice, adjustments are made to the table so that the grinding wheel will just touch the inner surface to be ground at all points. As the hole is gradually ground, the amount of eccentricity of the spindle is increased by turning the nut *D*. With this form of machine, holes from 1½ in. to 12 in. may be finished. The table for holding the work has a longitudinal motion, controlled by the customary form of tripping dogs that cause the table to travel back and forth, in a manner similar to that used on the general run of grinding machines.

There are a number of uses for this machine, as well as for the chucking grinders. The following will serve to illustrate their uses.

Holes in Valve Motion Levers and Bushings.—In repairing valve motion levers, parallel rods and various other similar parts, the holes in the rods or in the bushings or bearings applied to them are often found worn oblong or rough, or the holes in the levers are distorted as a result of the bushing becoming loose in the levers. In many cases these holes may be trued and thus avoid renewing the bushings or reaming the lever. Reaming would in some cases be the quicker operation, but it would not produce as true a hole and would result in enlarging the hole more than by grinding, thus shortening the useful life of the levers or rods. For the purpose of grinding these holes in levers, the piece may be clamped to an angle plate located on the machine table. In addition to valve motion levers, the holes in side rod knuckle pin bushings and a number of larger holes may be ground. Another use for this machine is that

of grinding the round holes in links into which the pin fits and also the holes in link blocks. These are often case-hardened and when they have become worn in service or when they have been warped in casehardening, it is much easier to true the holes by grinding than by any other method.

Air Brake Parts.—In addition to the internal grinding mentioned above, this form of machine shown may be profitably employed on various air brake parts, among which may be mentioned triple valves. The inner surfaces of the cylinders where the pistons travel should be refinished accurately and smooth. This desired surface can be obtained very quickly on the internal grinding machine and the work will be much superior to boring or reaming. For this operation the valve may be held on an angle plate secured to the machine table.

The valve chambers in the top heads of air compressors when worn, may also be refinished on this machine. For this purpose the head may be held on the machine table similar to the practice on a horizontial boring mill. The steam and air cylinders also may be refinished when worn or cut. For this operation the cylinder may be clamped to the table, similar to the method mentioned for pump heads. To refinish a very badly worn cylinder on this machine may require more time than on a boring machine on account of the large amount of metal to be removed in order to true up the entire surface. Even if this be the case, grinding will generally be the more economical when considering the life of the cylinders. When boring there is always the possibility of the workman setting the boring tools to a larger diameter than is necessary to true the cylinder in order to get below the hard surface. With grinding this danger does not exist, for the hard surface does not affect the grinding and the workman will naturally not do any more work than is necessary. Thus the bore will be enlarged just enough to remove the worn surfaces and will produce a surface equal to that given the best automobile cylinders. For this class of grinding it is the custom to grind the ridge at each end by short stroking the travel of the table until the diameter is about equal to the worn center and then allow the table to travel the full length of the cylinder.

PLAIN CYLINDRICAL GRINDERS

This form of machine may be used to good advantage in any railway shop. It would require too much space to enumerate all the uses that may be made of it. Of the more common may be mentioned the finishing of crank and knuckle pins, air pump piston rods, outer surfaces of valve motion bushings, knuckle pin bushings and piston and valve rods. Casehardened parts may be ground to a true cylindrical surface and irregularities as a result of heating when hardening may be corrected. With the present well developed grinding machines and grinding wheels, articles are finished cheaper and more superior to any other way. Therefore, this type of machine cannot be called a refinement, being valuable for new and repair work. In the latter case many a worn part may be finished that would be difficult and more expensive by other methods. Fig. 3 shows a typical grinding machine finishing piston rods.

Piston and valve rods are now largely ground in railway shops on gap grinders. This has proved a success both in the saving of time as well as in producing a superior finish. Also, when grinding, a smaller amount of metal is removed than would be necessary by the average turning. It is entirely possible by this method, to finish rods practically to one diameter for their entire length, which is an advantage in these days of superheated steam. Experience has shown that worn rods may be ground more quickly as they come to the shop without previous turning, than by first turning and then grinding. This includes rods that have been straightened and badly cut. The principal points are the proper grade of wheel, plenty of steady rests and cooling compound. For roughing down, the lateral feed is often one inch per revolution of the work and the depth of cut from .001 in. to .003 in., which gives an indication of the speed by which metal may be removed. If not kept fully employed on piston rods and valve stem rods, these gap piston rod grinders can be used to good advantage for grinding locomotive axles and crank pins. In some cases they are too light for the larger axles. However, they can readily be made to help out the lathes. For this work the axles or pins may be rough turned to about 1/32 in. large with the fastest feed the lathe will pull, and afterwards ground.

It is well recognized that the taper ends of crosshead, valve motion and similar pins should be carefully fitted to the taper holes in the levers or rods into which they are to be applied. These taper surfaces may be finished quickly and accurately on the plain cylindrical grinder. For this purpose the table is swiveled to the proper angle, similar to setting the taper attachment on a lathe, the table being graduated for the purpose.

The body or central portion of most of these pins is straight. Therefore, the taper is not continuous from end to end. This makes it necessary to grind one end back of the wheel and transfer the work to the opposite end. No difficulty is experienced in this operation. The customary method is to grind one end, preferably the larger, to a

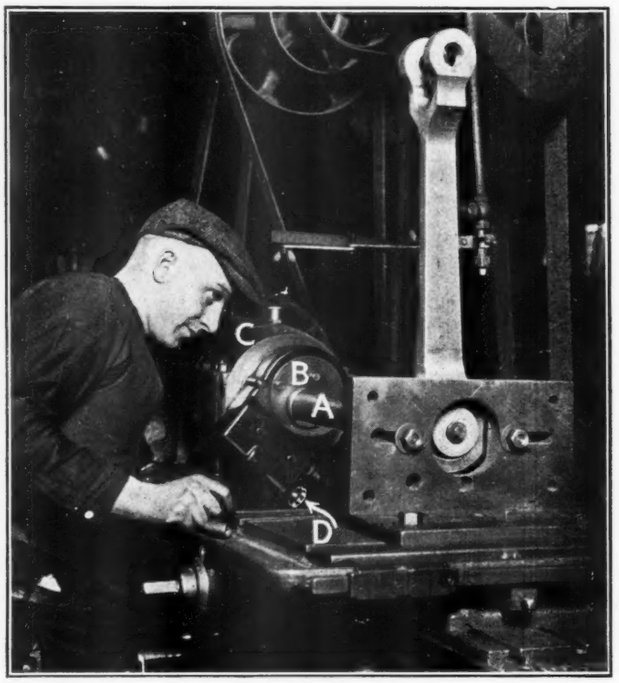


Fig. 2—Internal Grinding Machine Finishing a Bearing in a Valve Motion Link

size about .005 in. above size and set the knock-off dogs for the wheel feed or mark the micrometer dial, which may be done with the adjustable markers. The wheel is then shifted to the opposite end and the wheel fed into the previous setting. After this roughing down operation is completed, the wheel if rough or clogged with chips, should be trued with the diamond and the same operations gone through again for finishing to correct size and producing a smooth surface. Going over a pin a second time and truing the wheel may seem an extra refinement, but it will be found that the time required for this second operation will

be worth while for it will improve the finish and accuracy, which is essential with these parts. This method applies mostly to cases where only one or two pins are finished at one time.

For new work or large batches of work the pins may all be roughed down and afterwards finish ground without too frequent trueing of the wheels. In some cases the pins are roughed to size and finished all in one operation, the method depending largely on the grade of grinding wheel employed. This grinding of the taper end may be done by feeding the wheel directly onto the work, in which event the wheel must be as thick as the surface is long; or the wheel may be given a lateral motion. The first method is quicker, but it is necessary to keep the wheel in perfect condition. For pins that are casehardened it is about the only method that may

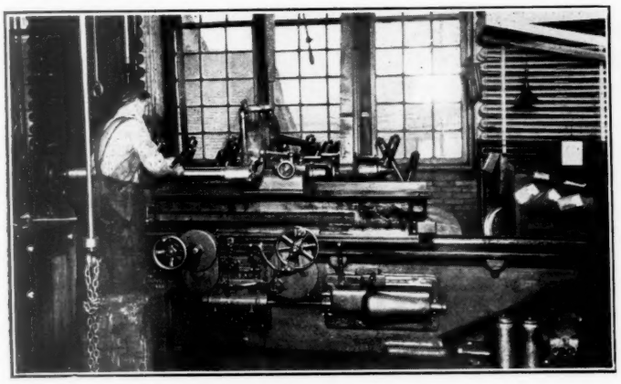


Fig. 3—Grinding a Piston Rod on a Cylindrical Grinding Machine

be followed to finish them perfectly true and to correct distortion from hardening.

The grinding of the straight surfaces of the pins is a simple operation. It is, however, very important that they fit the hole into which they are to work in a proper manner. Where the various valve motion, crosshead and similar pins are roughed out in quantities on automatic screw machines or turret lathes or in so-called central production shops the grinding machines will be found useful for the final fitting of these parts to the individual locomotives. For this method of manufacture the roughed out parts need not be closer to size or smoother than that which may be obtained by a single roughing out. Where unhardened pins are used it will be found that even if they are made considerably over size, they may be reduced to the required dimensions very quickly.

Where casehardened pins are used the grinder will prove useful. Before the pins are hardened they may be roughed out and the other work done, such as cutting keyways and drilling the necessary holes, the only requirement being to machine the straight portion close to size so that after being hardened, it will not be necessary to grind below the casehardened surface. The taper part of the pins may be left with a relatively larger amount of material to remove in finishing as grinding below the casehardened surface is not considered objectionable. This will make it possible to keep pins in stock all casehardened and where it is necessary to fit them to a locomotive, delays of waiting for parts to be casehardened will be avoided. Various sizes of semi-finished pins will be required to meet the requirements for repair work especially where the pins are casehardened in batches.

The grinding method is useful for refinishing pins that are only slightly worn, as a new surface may be obtained with a diameter minimum waste of metal. This practice is particularly valuable for repairing crosshead pins as the small reduction in the diameter of the pin will require the brasses to be closed but little. If the pin were to be turned by the customary method a greater reduction in diameter would be necessary.

For finishing crank pins the grinder will be found useful. The more economical method of manufacture is to rough out those pins on turret or center lathes, making the journal surfaces from 1/64 to 1/32 in. large and the part fitting the wheel center large enough to meet the conditions caused by lack of uniform size in the original boring and enlargements resulting from renewing pins. The sides of the shoulders may be finished in the lathe when the pins are made or they made be made by grinding, it being necessary to remove the sharp corner of the grinding wheel to form the proper radius. This may readily be done with radius trueing devices supplied by the makers of grinding machines. The part of the pin fitting the wheel center which generally varies in diameter for each pin may, also, be ground, and if it is only necessary to remove about 1/16 in. of metal, will generally be found quicker than turning. For this fitting the bore of wheel center can, to good advantage, be measured with inside micrometer calipers. Where this is done a memorandum of the size may be given to the grinder operator who can then finish the pin to the correct size for force fit. The use of micrometers for this purpose has several advantages over fitting with machinist calipers, for it is not necessary for the workman to leave his machine to go to the wheel center. In fact the information concerning the sizes can be transmitted by telephone from one shop to another. One of the greatest advantages will be that the workman will soon become accustomed to working to exact sizes which will result in allowing a uniform amount for force fit of these parts.

It is now a practice with a number of concerns to make bushings on automatic screw machines or turret lathes and afterwards grind the outside diameter to the correct size instead of endeavoring to keep to exact sizes when making them on the machine, because it was found that the time lost on the screw machines or lathes was greater than that of grinding, also the grinding resulted in superior finish and greater accuracy. The bushings used on locomotives are generally short and can be ground quickly. Where a number are to be ground at one time, it is the custom to use two arbors; while grinding on one, the second is being loaded. This practice can be used to good advantage both for steel and brass bushings. Grinding brass parts may also look like an extra refinement; its economy lays in the fact that close sizes may be obtained quicker by this method.

The internal and cylindrical grinders as mentioned above will do work now largely done on lathes in railway shops. Where additional machine tools are necessary they should be carefully considered. As far as operators are concerned a green man or woman can be broken in to operate a grinder quicker than they could be to run a lathe. The surfaces will be superior and the work can be done quicker. They however have their limitations and where a large amount of metal is to be removed they cannot compete with the lathe. But for finish and accuracy the grinders are superior.

SURFACE GRINDING

The surface grinder is now finding favor in railway shops, it being well adapted for a large amount of work. Its principal use is that of finishing crosshead guides, ends of main rods, rod keys and wedges and other flat surfaces. As now developed a number of jobs can be done on this machine quicker than on planers or shapers and produce a superior finish. Some of the machines are equipped with a magnetic chuck by which the work can be held without clamping and which saves a large amount of time when setting up a job as compared with the methods customarily followed when securing to a planer bed, this chuck being one of the very handy devices for railway work.

One of the principal uses for this machine is that of

finishing both new and repaired crosshead guides. Where the magnetic chuck is used the guide can be lined up on the chuck and the current for the magnet switched on. This is about all that is necessary for securing the work.

With new guides the tool marks from planing can be removed quickly on the surface grinder and guides worn in service may be resurfaced readily. As a general proposition a cut from .001 in. to .003 in. may be taken at each pass of the wheel. As this covers the entire surface of the guide, that may be several inches wide, the rate of cutting is fairly rapid. Worn guides may be resurfaced quicker than planing under ordinary conditions. For an extra worn guide it may be advisable to plane before grinding. The advantages of guide bar grinding are a reduction in the time required to do the work, the superior finished surface obtained and the fact that only enough metal is removed to true up the guide.

This machine is also finding favor for grinding the flat surfaces on the ends of main and side rods (Fig. 4), both for new and repair work. For new work the various blocks, straps and wedges that should be finished flush with the sides can first be planed fairly close to size and then assembled in the rod and all ground at one time. This results in all these

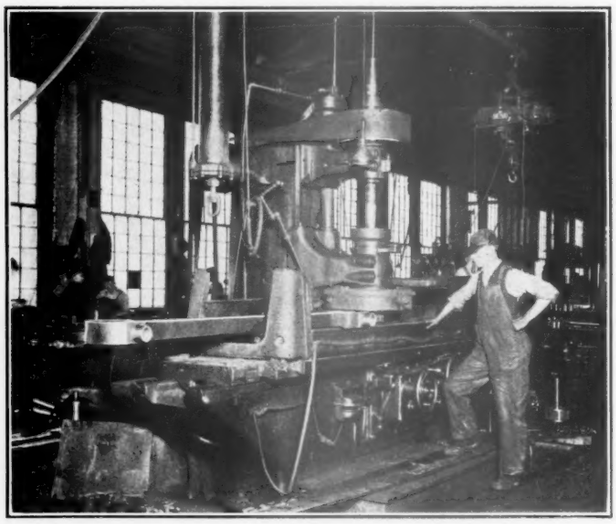


Fig. 4—Locomotive Side Rod Being Finished on a Surface Grinder

parts membering properly, also on account of the ease of measuring the ground surfaces the thickness of the rods can be made practically to drawing size, thus making the rods as far as thickness is concerned interchangeable. Worn rods may be ground on their sides to remove depressions caused by wear. This also results in the proper truing up of the rod ends which is an advantage when fitting new rod brasses. The ends of side rods are ground for the purpose of removing the roughness due to planing or milling and to insure a uniform thickness of all rods.

A number of rod keys are now ground on their flat surfaces. Where they are forged close to the required finish size as in the case of drop forging, they can be ground from the rough very quickly. When performing this operation it is the custom to cover the entire surface of the magnetic chuck with these parts. In placing these small parts on the chuck the only precaution necessary is to locate the pieces so they will rest against each other to prevent shifting and to keep the surface of the chuck clean.

Washers for crank pins and crosshead pins are also finished on the surface grinders. In this event the washers are cut from boiler or scrap sheet steel to the required diameter and the holes bored, as the sides are ground from the rough, it is not necessary to turn the flat sides. Also thinner sheet steel may be used than would be the case if the washers were to be turned in a lathe.

Some of the surface grinders have large circular magnetic chucks. These machines may be used to good advantage for grinding the sides of piston, air pump and piston valve packing rings. The ground sides are superior to the average work done on a lathe or boring mill.

A large number of uses can be found for surface grinders and the question of their installation is well worth consideration. These machines like the grinders mentioned above may be operated by workmen having less experience than would be necessary to operate other machines for doing the same work.

GENERAL RESULTS FROM GRINDING

The advantages to be deprived from grinding may be summed up under the grade of the work performed and the accuracy.

Grade of Work.—The finish produced by grinding is universally conceded to be superior to that produced by other methods. The bearing surfaces are more accurate and any degree of smoothness can be obtained. For cylindrical pieces such as cross head pins, knuckle pins, valve motion pins, piston rods, etc., the bearing can be made of one diameter for their entire length. To produce a similar surface on a lathe requires an expert who will generally take a greater amount of time. Unquestionably this high grade of finish is desirable for locomotive work. Where casehardened parts are used the surfaces cannot be made accurate unless they be ground. Internal surfaces such as the various bearings and bushings may also be finished more accurately than by other methods, such as reaming, turning and lapping. In casehardening the parts are bound to warp and distort to a certain extent as result of the high degree of heating necessary for this operation. Where such parts are not ground the pins will will naturally have a poor bearing in the companion bearing, with the possibility of it cutting or galling. Whereas where the parts are ground the surfaces will be true, making a good bearing for the entire length and also the proper amount of play may be allowed for the flow of oil, lost motion, etc. Soft pins and bushings may also be ground and obtain the same degree of accuracy. Bearings of this nature will naturally wear longer and what is more important reduce locomotive detention.

Accuracy.—A ground cylindrical surface is more easily measured than a turned surface. This is brought about from the fact that where a grinding machine is set to grind straight a measurement taken at any point will show the diameter for the entire length of the piece. In other words it is not necessary to measure at several points as is the general practice where a piece is turned and then filed and then finished with emery. For various pins, piston rods, etc., the micrometer caliper may be used very quickly. This method of measuring has the advantage as compared with solid gages or machinists' calipers that the first measurement shows the exact amount the piece is above the required size and also how much is to be removed.

Briquettes of Lignite in Canada.—The Canadian Council for Scientific and Industrial Research intends to manufacture carbonized lignite briquettes. A plant costing about £80,000 will be constructed near Estevan, Saskatchewan. The proposal is to take two tons of poor lignite with about 32 per cent of moisture and 7300 B.t.u. per lb., and turn them into one ton of briquettes containing 5 per cent moisture, and having a fuel value of 12,000 B.t.u. Sulphite liquor, the waste product from pulp mills, will be used as the binder; it is smokeless and odorless.—*Iron Age.*

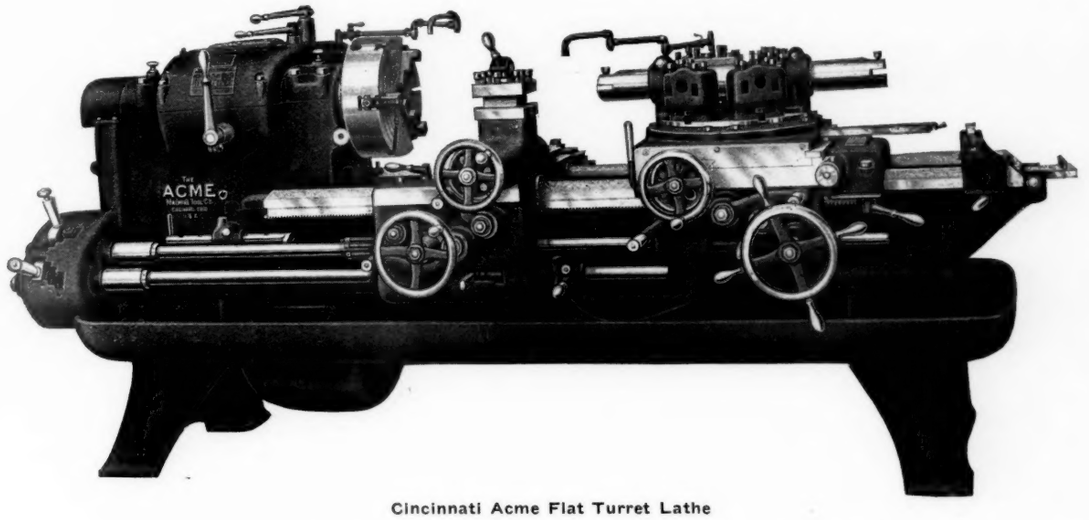
CINCINNATI ACME FLAT TURRET LATHE

A new universal flat turret lathe, embodying many noteworthy features is the latest product of the Acme Machine Tool Company, Cincinnati, Ohio. This machine is well suited to handle a wide range of work, which makes it particularly well adapted for use in railroad shops. The lathe has a capacity for bar work up to 3½ in. in diameter and 44 in. long and for checking work up to a diameter of 17 in. It is equipped with a side carriage that can be used on either bar or chucking work, thus greatly reducing the time on operations where two tools can be used simultaneously. All control levers have been centralized so that they are directly in front of the operator. Rigidity and perfect alinement between the spindle and the vees are assured by casting the head solid with the bed.

The machine is driven through a 14 in. pulley running at constant speed. The geared head gives nine speeds, ranging from 14 to 280 r. p. m. A patented gear-shifting device makes it possible to change from any speed to any other with one continuous movement of either of the two speed changing levers located on the head. When the lever has reached the point where the gears are out of mesh the driving pulley is automatically disengaged from the friction and re-engaged after the gears are again completely in mesh. The spindle is mounted in removable babbitt bearings and can be instantly started, stopped or reversed by a double cone friction operated by a lever in front of the head.

The side carriage spans the ways of the bed. It clears the chuck and can be moved out of the way to permit the use of short tools in the flat turret. It has six independent stops for the longitudinal movement which are readily accessible. The square turret mounted on the cross slide is positioned by a lock bolt and can be indexed to four positions.

The cross sliding turret revolves on a stem of large diameter and is automatically locked in position by a taper plunger, working in bushings set into the solid turret. The turret is further held down at the extreme outer edge with circular clamps. The cross slide moves on a narrow dovetail guide which has a taper gib to compensate for wear. The cross speed can be operated in both directions by hand or by power. The saddle has a continuous bearing for its entire length on the vees. Power rapid traverse is provided in either direction for the turrets. Twelve longitudinal stops are provided for the turrets, one independent stop for each face and six auxiliary stops operated by an index knob at the right of the saddle. When desired, as many as seven different shoulder lengths can be machined. To pass any of the 12 longitudinal stops it is only necessary to turn the index knob half-way between any of the numbers. Power feeds are provided for both the cross and longitudinal movements of the side carriage and the turrets. A gear box at the head of the machine furnishes ten speeds from 10 to 240 r. p. m. Positive stops are provided for the longitudinal movements, while the cross movements have large micrometer dials with observation stops. All feeds can be reversed by levers in the apron.



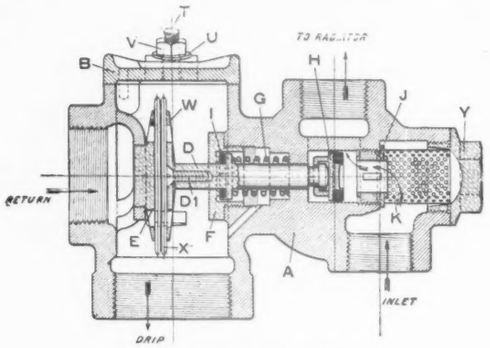
Cincinnati Acme Flat Turret Lathe

The bed is heavy and strongly braced by cross girths, with exceptionally large vees. A geared oil pump furnishes an ample supply of coolant with the machine running in either direction. The oiling piping is so arranged that coolant can be fed to each individual tool. A plain, tight and loose pulley countershaft is furnished with this machine, but where

conditions permit, the driving pulley may be belted direct to the line shaft. A 5 to 7½ hp. constant speed motor is recommended where individual drive is to be used.

GOLD INSIDE CONNECTED VAPOR VALVE

In the application of the vapor heating system to passenger cars the usual practice has been to place the vapor regulating valve underneath the car. To overcome the objections arising from the inaccessibility of this location and the extreme ex-



Section Through the Valve Body

posure to which the valve is subjected, the Gold Car Heating & Lighting Company has placed on the market an inside connected vapor valve which is designated as No. 1112.

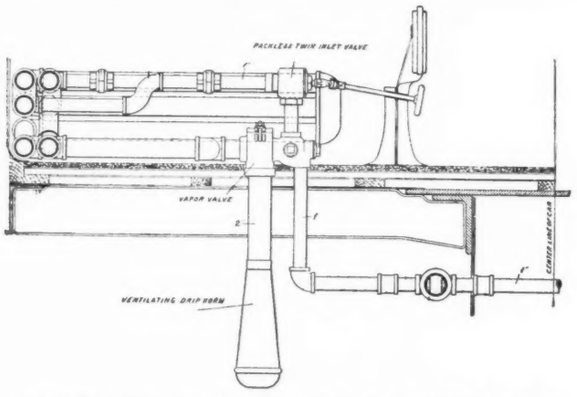
The construction and operation of the valve is simple and may readily be grasped from an inspection of the sectional view. At the right are the branch pipe and radiator admission connections, the steam passing from the former to the

Gold No. 1112 Inside Connected Vapor Valve

latter through the diaphragm controlled admission valve *H*. The operation of the admission valve is controlled by an expansion diaphragm of a design which provides sufficient flexibility to obviate the necessity of the use of an adjusting screw within the range of the working pressure encountered in passenger train heating practice. The movement of the diaphragm is transmitted to the valve by a single straight stem which is normally held in position against the diaphragm by the coil spring *G*. The valve is thus always open except when closed under the action of the expansion of the diaphragm. The sensitiveness of the valve is not impaired by the use of packing on the stem.

All working parts of the valve are readily accessible. The diaphragm chamber is closed by a flat cover *B*, held in place by two swing bolts *T*. The joint between the cover and the casing is steam tight without the use of a gasket. By removing this cover the diaphragm may quickly be removed, if necessary while the system is in operation, to accomplish which it is only necessary to turn off the steam temporarily. The admission valve disk slides into place on the end of the main stem, and may be removed by first removing the plugs in the opposite sides of the admission valve chamber.

One of the illustrations shows the position of the vapor valve with relation to the rest of the system. With the valve inside the car, in order that the temperature in the diaphragm chamber may be sensitive to outside conditions, a ventilating drip horn is used. This is divided into two parts by a vertical diaphragm, the lower end of which extends below the bottom of the horn, placed at right angles to the longitudinal center



Location of the No. 1112 Vapor Valve in the Heating System

line of the car. With the car in motion, or with a wind blowing, a draft is created up one side of the ventilating horn and down the other, which ventilates the diaphragm chamber and maintains the sensitiveness of the operation of the valve. On the basis of service tests it is claimed that the valve will maintain practically a constant temperature at the return of 210 deg. F. On the other hand, with the radiators turned off, the compactness of the valve case and the directness of the operating connection between the valve and the diaphragm insures that all these parts will be sufficiently warmed by direct conduction to prevent freezing. The valve complete with the ventilating drip horn weighs only 16 lb.

SEAMLESS HOLLOW STAYBOLT IRON

The use of hollow staybolts in locomotive fireboxes has become widespread during the past few years. This is due to the fact that the federal locomotive inspection rules provide that where hollow staybolts are installed behind brick work or grate bearers, the removal of the bricks or grates each month for the purpose of hammer testing such bolts will not be required. Particular interest therefore attaches to the announcement that seamless hollow staybolts are now being manufactured from Ulster Special iron in a plant recently erected by Joseph T. Ryerson & Son, Chicago. This hollow iron is produced from the solid bar and it can be furnished to pass all railroad or other standard specifications for staybolt iron and is guaranteed not to split or develop leaks in driving.

It has been the aim in producing this hollow staybolt iron to diverge from the present practice in this country of making hollow iron from welded sections. There has been no change in the process of manufacturing the Ulster Special iron used in these bolts. This new product combines the reliability of the best solid staybolt iron with the advantages of the hollow bolt.

Railway Mechanical Engineer

(Formerly the RAILWAY AGE GAZETTE, MECHANICAL EDITION *with which the* AMERICAN ENGINEER *was incorporated)*

PUBLISHED ON THE FIRST THURSDAY OF EVERY MONTH BY THE
SIMMONS-BOARDMAN PUBLISHING COMPANY

EDWARD A. SIMMONS, *President* M. H. WIUM, *Secretary*
HENRY LEE, *Vice-President and Treasurer* L. B. SHERMAN, *Vice-President*
WOOLWORTH BUILDING, NEW YORK, N. Y.
F. H. THOMPSON, Business Manager, CHICAGO.

Chicago: Transportation Bldg. Cleveland: Citizens' Bldg.
Washington: Home Life Bldg.
London: Queen Anne's Chambers, Westminster.

ROY V. WRIGHT, *Editor*
R. E. THAYER, *Managing Editor*
C. B. PECK, *Associate Editor* A. F. STUEBING, *Associate Editor*
C. W. FOSS, *Associate Editor*

Entered at the Post Office at New York, N. Y., as mail matter of the second class.

Subscriptions payable in advance and postage free; United States, Canada and Mexico, $2.00 a year; Foreign Countries, $3.00 a year; Single Copy, 20 cents.

WE GUARANTEE, that of this issue 6,600 copies were printed; that of these 6,600 copies 5,733 were mailed to regular paid subscribers, 57 were provided for counter and news company sales, 188 were mailed to advertisers, 64 were mailed to employees and correspondents, and 558 were provided for new subscriptions, samples, copies lost in the mail and office use; that the total copies printed this year to date were 84,350, an average of 7,668 copies a month.

THE RAILWAY MECHANICAL ENGINEER is a member of the Associated Business Papers (A. B. P.) and the Audit Bureau of Circulations (A. B. C.)

The War Department, through the department of military railways, is placing orders for approximately 40,000 freight cars for service on military railways in France, some of which may be loaned to French government railways by General Pershing.

The Federal Labor Bureau at Altoona, Pa., has calls constantly for large numbers of artisans, mechanics and laborers. The last list received from the Pennsylvania Railroad specifies 8,087 positions which need to be filled on that road. More than 200 men are wanted in the shops in that city, and 350 laborers on track work. The Cambria Steel Company is looking for 1,100 men, mostly laborers.

Make Every B. O. Locomotive a Live One

We cannot assume that there will be an early cessation of fighting. We are not going to stop fighting until we get this thing finished. Pershing needs locomotives—why? Because we have the Germans on the move to Berlin and they are moving so fast that it takes American locomotives to keep up with them. Pershing wants locomotives that we need for the railroads of the United States, and he wants steel rails over there to put those locomotives on so he can keep up with the Germans. I have said that General Pershing can have those locomotives, as we railroad men will see that he gets anything he needs from the railroads of the United States. We can give him those locomotives only if you make every bad order locomotive a live one as quickly as you possibly can do it. I want you to work all the harder on these dead locomotives. A bad order locomotive is a Prussian soldier, and I want you to jump on every Prussian soldier that gets into the shops, mark "Prussian" on him in chalk and then hammer hell out of him until you convert him into a live American soldier. This is the way you can help Pershing and the boys in France. (From an address by Director General W. G. McAdoo at Connellsville (Pa.) shops on October 13.)

Revision of M. C. B. Interchange Rules for 1918-19

All prices shown in rules 98, 101, 107, 111 and 112 of the M. C. B. rules became effective October 1, 1918, according to Supplement *A* to Circular No. 16, referring to the revised interchange rules. Revised rules 104, 106 and 108 also became effective October 1, 1918. However, it should be understood that old rules 58 and 95 governing responsibility are still effective. That portion of rule 104 which allows material charge for missing brake beams, and that portion of rule 111 which allows charge for missing airbrake parts is effective November 1, 1918.

Circular No. 45, which provides that no bill shall be made for certain items of minor repairs to railroad-owned cars, has been modified to apply only to cars belonging to roads under United States federal control; this provision also became effective October 1, 1918, and is known as Article III.

More Cars and Locomotives Ordered

It is reported that the United States Railroad Administration has ordered 600 locomotives in addition to the 1,415 which have already been ordered. It is expected that 500 of these will be built by the American Locomotive Company and 100 by Lima, the orders being distributed as follows: American Locomotive Company 150 eight-wheel switchers, 50 six-wheel switchers, 150 light Mikados, 50 heavy Mikados,

RAILROAD CLUB MEETINGS

Club	Next Meeting	Title of Paper	Author	Secretary	Address
Canadian	Nov. 12, 1918	Co-ordination of the Various Branches of the Mechanical Department	W. U. Appleton	James Powell	P. O. Box 7, St. Lambert, Que.
Central	Nov. 14, 1918	Discussion: How Can a Railroad Man Help Win the War? Annual dinner		Harry D. Vought	95 Liberty St., New York.
Cincinnati				H. Boutet	101 Carew Bldg., Cincinnati, Ohio.
New England	Nov. 12, 1918	Looking Forward	J. H. Hustis	W. E. Cade, Jr.	683 Atlantic Ave., Boston, Mass.
New York	Nov. 15, 1918	Purpose and Work of the Fuel Conservation Section	Eugene McAuliffe	Harry D. Vought	95 Liberty St., New York.
Pittsburgh				M. J. Hepburn	102 Penn Station, Pittsburgh, Pa.
St. Louis	Nov. 8, 1918	Organization of the Students' Army Training Corps	Prof. A. S. Langsdorf	B. W. Frauenthal	Union Station, St. Louis, Mo.
Western	Nov. 18, 1918	Work and Organization of the Fuel Conservation Section	Major E. C. Schmidt	A. F. Stuebing	750 Transportation Bldg., Chicago.

25 light Santa Fe locomotives and 75 Mallets of the 2-8-8-2 type. The Lima Locomotive Corporation is to have 100 light Mikados.

It is also reported that 2,000 coal cars will be built to the designs of the Norfolk & Western's 100-ton type cars with six-wheel trucks, with the exception of certain standards adopted on the other standard freight cars. These will be built for the Virginian in order to enable that road to use cars of high capacity to accommodate the requirements of that road. But few of these cars will get off the line of the Virginian.

MEETINGS AND CONVENTIONS

New York Railroad Club.—At the recent monthly meeting of the New York Railroad Club, D. W. Pye, president of the Tuco Products Company, Inc., was elected treasurer to succeed the late R. M. Dixon. Roy V. Wright, editor of the *Railway Mechanical Engineer,* has been appointed chairman of the subjects committee.

Manufacturers of Chilled Car Wheels.—The Association of Manufacturers of Chilled Car Wheels held its annual meeting October 15 at the Waldorf-Astoria, New York. The following officers were elected for the coming year:

President and treasurer, George W. Lyndon; vice-presidents, E. F. Carry, president, Haskell & Barker Car Company, and J. A. Kilpatrick, president, Albany Car Wheel Company; secretary, George F. Griffin, president, Griffin Wheel Company; consulting engineer, F. K. Vial, chief engineer, Griffin Wheel Company.

Railway Equipment Manufacturers' Association.—At the annual meeting of the Railway Equipment Manufacturers' Association, which was held during the Traveling Engineers' Convention, $100 was contributed to the Railway Regiments' Tobacco Fund and $200 to the American Red Cross. The following officers were elected for the ensuing year: President, Gilbert E. Ryder, Locomotive Superheater Company; vice-president, C. W. Floyd Coffin, Franklin Railway Supply Company; secretary, D. L. Eubank, Galena Signal Oil Company; treasurer, B. C. Hooper, American Steel Foundries; executive committee members for three years, C. L. Brown, Manning, Maxwell & Moore; Morris Brewster, United States Metallic Packing Company, and F. W. Venton, Crane Company.

The following list gives names of secretaries, dates of next or regular meetings and places of meeting of mechanical associations:

Air Brake Association.—F. M. Nellis, Room 3014, 165 Broadway, New York City.

American Railroad Master Tinners', Coppersmiths' and Pipefitters' Association.—O. E. Schlink, 485 W. Fifth St., Peru, Ind.

American Railway Master Mechanics' Association.—V. R. Hawthorne, 746 Transportation Bldg., Chicago.

American Railway Tool Foremen's Association.—R. D. Fletcher, Belt Railway, Chicago.

American Society for Testing Materials.—C. L. Warwick, University of Pennsylvania, Philadelphia, Pa.

American Society of Mechanical Engineers.—Calvin W. Rice, 29 W. Thirty-ninth St., New York.

Association of Railway Electrical Engineers.—Joseph A. Andreucetti, C. & N. W., Room 411, C. & N. W. Station, Chicago.

Car Foremen's Association of Chicago.—Aaron Kline, 841 Lawlor Ave., Chicago. Meetings second Monday in month, except June, July and August, Hotel Morrison, Chicago.

Chief Interchange Car Inspectors' and Car Foremen's Association.—W. R. McMunn, New York Central, Albany, N. Y.

International Railroad Master Blacksmiths' Association.—A. L. Woodworth, C. H. & D., Lima, Ohio.

International Railway Fuel Association.—J. G. Crawford, 542 W. Jackson Blvd., Chicago.

International Railway General Foremen's Association.—William Hall, 1061 W. Wabasha Ave., Winona, Minn.

Master Boilermakers' Association.—Harry D. Vought, 95 Liberty St., New York.

Master Car Builders' Association.—V. R. Hawthorne, 746 Transportation Bldg., Chicago.

Master Car and Locomotive Painters' Association of U. S. and Canada.—A. P. Dane, B. & M., Reading, Mass.

Niagara Frontier Car Men's Association.—George A. J. Hochgrebe, 623 Brisbane Bldg., Buffalo, N. Y. Meetings, third Wednesday in month, Statler Hotel, Buffalo, N. Y.

Railway Storekeepers' Association.—J. P. Murphy, Box C, Collinwood, Ohio.

Traveling Engineers' Association.—W. O. Thompson, N. Y. C. R. R., Cleveland, Ohio.

Personal Mention

FEDERAL ADMINISTRATION APPOINTMENTS

William W. Morris, formerly of the purchasing department of the Pennsylvania, at Philadelphia, has been appointed secretary of the Central Advisory Purchasing Committee, with office at Washington, D. C.

Thomas E. Paradise, whose appointment as mechanical assistant on the staff of the Central Western regional director, with headquarters at Chicago, was announced in the October *Railway Mechanical Engineer,* was born at Peoria, Ill., on November 22, 1880. Mr. Paradise entered railway service on October 2, 1897, as a machinist apprentice with the Chicago, Burlington & Quincy at Hannibal, Mo. Five years later he enlisted in the United States navy as a second-class machinist, in which capacity he served four years. At the expiration of his enlistment he returned to Hannibal and entered the service of the Chicago, Burlington & Quincy as a machinist. In 1912, he was promoted to roundhouse foreman at LaCrosse, Wis., and in 1916, he became master mechanic at Centerville, Iowa. The following year he was transferred to Hannibal in the same capacity, where he remained until his appointment as mentioned above.

F. S. Wilcoxen, special representative of the Perolin Railway Service Company at Chicago, has been appointed assistant fuel supervisor of the Northwestern region of the Railroad Administration, with headquarters at Portland, Ore. Mr. Wilcoxen's biography and picture were published in the *Railway Mechanical Engineer* for January, 1918, on page 71.

GENERAL

W. J. Bohan, mechanical engineer of the Northern Pacific, has been appointed assistant mechanical superintendent, with headquarters at St. Paul, Minn.

B. J. Farr, master mechanic of the Grand Trunk (Western Lines), at Battle Creek, Mich., has been appointed superintendent of motive power and car department of the Western Lines, with headquarters at Detroit, Mich., succeeding W. H. Sample, who has gone to the Grand Trunk in Canada.

T. A. Foque, general mechanical superintendent of the Minneapolis, St. Paul & Sault Ste. Marie, has had his jurisdiction extended to include the Duluth, South Shore & Atlantic and the Mineral Range, with headquarters at Minneapolis, Minn.

J. F. Graham, superintendent of motive power of the Oregon-Washington Railroad & Navigation Company, with office at Portland, Ore., has had his jurisdiction extended over the Southern Pacific north of Ashland, and the Pacific Coast Railroad.

H. F. Greenwood, superintendent of shops of the Norfolk & Western, with office at Roanoke, Va., has had his jurisdiction extended to include all departments at East Roanoke shops.

G. O. Hammond, general mechanical superintendent of the New York, New Haven & Hartford, with offices at New Haven, Conn., has resigned, effective November 1.

R. E. Jones has been appointed fuel and oil supervisor of the Duluth & Iron Range and the Duluth, Missabe & Northern.

A. Kearney, assistant superintendent motive power of the Norfolk & Western at Roanoke, Va., has been appointed superintendent motive power, with office at Roanoke, succeeding W. H. Lewis, retired.

E. R. MANOR, chief electrician of the Northern Pacific, at St. Paul, Minn., is now assistant engineer of tests.

A. J. MERRIWETHER, road foreman of engines of the Mobile & Ohio and the Southern Railroad in Mississippi, has been appointed fuel supervisor, with office at Jackson, Tenn.

W. L. ROBINSON has been appointed supervisor of fuel consumption on the Baltimore & Ohio Western Lines, the Dayton & Union Railroad, and the Dayton Union Railroad, with headquarters at Cincinnati, Ohio.

SILAS ZWIGHT, general master mechanic of the Northern Pacific, has been appointed assistant mechanical superintendent, with headquarters at St. Paul, Minn.

MASTER MECHANICS AND ROAD FOREMEN OF ENGINES

J. J. BARRY, master mechanic of the Norfolk & Western at Portsmouth, Ohio, has been appointed general master mechanic, with office at Roanoke, Va. He will have jurisdiction over all shops and motive power department employees other than at East Roanoke shops.

G. W. CUNDIFF has been appointed road foreman of engines of the Mobile & Ohio and the Southern Railroad in Mississippi, with headquarters at Jackson, Tenn., succeeding A. J. Merriwether, transferred to other duties.

C. GRIBBON has been appointed division master mechanic of the Canadian Pacific, London division, with office at London, Ont., in place of A. Maynes, transferred.

HARRY MODAFF has been appointed division master mechanic of the Chicago, Burlington & Quincy, at Hannibal, Mo., succeeding Thomas E. Paradise, promoted.

W. WALTON has been appointed division master mechanic of the Canadian Pacific Eastern Lines, at Farnham, Que., succeeding W. Wells, transferred.

JAMES D. YOUNG has been appointed road foreman of engines on the Lehigh & Susquehanna division of the Central of New Jersey, with office at Ashley, Pa.

CAR DEPARTMENT

J. BROOKS has been appointed assistant master car builder of the Grand Trunk, at the London, Ont., shops.

I. N. CLARK has been appointed master car builder on the Ontario lines of the Grand Trunk, with headquarters at London, Ont., succeeding T. A. Treleaven, retired.

W. F. PAULUS has been made steel car foreman of the Erie at Kent, Ohio, succeeding I. M. Lower, transferred.

W. A. PITT has been appointed assistant master car builder at the Montreal, Que., shops of the Grand Trunk.

SHOP AND ENGINEHOUSE

W. A. BLACK has been appointed locomotive foreman of the Canadian Pacific at Farnham, Que., succeeding D. W. Watson, transferred.

PURCHASING AND STOREKEEPING

J. H. CLEMMITT has been appointed purchasing agent of the Norfolk & Western, with office at Roanoke, Va., succeeding E. T. Burnett. Mr. Clemmitt was born November 20, 1881, in Richmond, Va. He was educated in the public schools and entered the service of the Norfolk & Western in November, 1896, filling various positions in the office of the purchasing agent. His entire railroad and business experience has been with the Norfolk & Western. On December 1, 1913, he was appointed chief clerk, which position he held until his recent appointment as purchasing agent.

W. L. ECTOR, division storekeeper of the Central of Georgia, with office at Cedartown, Ga., has been appointed division storekeeper at Columbus, succeeding R. L. Geeslin.

C. S. FILLER has been appointed storekeeper of the Baltimore & Ohio Railroad, Eastern Lines, with office at Keyser, W. Va., succeeding E. A. Workman, transferred.

T. C. HOPKINS, assistant storekeeper of the Baltimore & Ohio, Eastern Lines, at Glenwood, Pa., has been appointed storekeeper with the same headquarters, succeeding T. H. Barker, assigned to other duties.

W. A. LINN, purchasing agent of the Chicago, Milwaukee & St. Paul, with headquarters at Chicago, has had his jurisdiction extended over the Escanaba & Lake Superior and the Ontonagon Railroad, with the same headquarters.

E. T. STONE, purchasing agent of the Minneapolis, St. Paul & Sault Ste. Marie, with office at Minneapolis, Minn., has had the Lake Superior Terminal & Transfer Railroad included in his jurisdiction.

G. P. WARD has been appointed division storekeeper of the Central of Georgia at Cedartown, Ga., succeeding W. L. Ector.

O. H. WOOD, assistant purchasing agent of the Great Northern, at Seattle, Wash., has been appointed purchasing agent of the Pacific Coast Railroad, with the same headquarters, succeeding G. W. Saul.

OBITUARY

ROBERT A. BILLINGHAM, for the last two years mechanical superintendent of the Tennessee Central with office at Nashville, Tenn., died on September 29 at Schenectady, N. Y.

HIRAM W. BELNAP, manager of the safety section of the division of operation, United States Railroad Administration, and formerly for seven years chief of the Bureau of Safety of the Interstate Commerce Commission, died at his home in Washington on October 12, of pneumonia, following an attack of the Spanish influenza. Mr. Belnap was 51 years of age and had been connected with the Interstate Commerce Commission for 15 years. For eight years he was an inspector of safety appliances for the commission and in 1911 he was made chief inspector of safety appliances, his title having been changed later to chief of the Bureau of Safety. Previous to his connection with the commission he had 14 years of experience in various capacities in practical railroad service in train operation. He was appointed manager of the safety section under the Railroad Administration last February and for a time continued to exercise his usual functions with the Interstate Commerce Commission, but on July 1 he resigned his office with the commission to devote his entire time to the new work, in which he has been engaged in supervising and organizing the safety departments of the railroads in accordance with a uniform plan designed to provide centralized supervision, not only to insure proper practices, but in order that each railroad might promptly secure the advantage of experience which other roads have had in safety work.

H. W. Belnap

ROY B. SMITH, assistant electrical engineer, Pennsylvania Lines West, at Columbus, Ohio, died on October 19.

Supply Trade Notes

Oscar F. Ostby, railway supplies, has moved his office from 2736 Grand Central Terminal, New York, to Room 1044 in the same building.

M. M. Auerbach, assistant secretary and assistant treasurer of the National Railway Devices Company of Chicago, died at his home in that city on October 9.

S. W. Baker has been appointed manager of the extra work department of the Lima Locomotive Works, Inc., and M. K. Tate has been appointed manager of the service department.

C. D. Norton, sales engineer for the Page Steel & Wire Company, New York, has resigned that position to become a captain in the General Engineer Depot, U. S. A., at Washington.

H. G. Elfborg, consulting engineer and director of the Ajax Forge Company, has severed his connection with that concern. Mr. Elfborg was connected with that company for the past 23 years.

The Pacific Car & Foundry Company is having plans prepared for a one-story plate shop, 100 ft. by 340 ft., to be constructed on East Fifty-fifth street, Portland, Ore. The building will cost about $30,000.

Garland P. Robinson, who has been assistant chief inspector of locomotive boilers for the Interstate Commerce Commission since March, 1911, resigned that office to take a place with the American Locomotive Company.

Frank W. Furry, president of the Ohio Injector Company, died at his home in Chicago on October 23, after a short illness, at the age of 60 years. Mr. Furry was born at Wadsworth, Ohio, on February 25, 1858. From 1884 to 1893 he was connected with the Ferdinand Shumacher Milling Company, now the Quaker Oats Company, and was then until April, 1894, in railway service, having been employed on the Atlantic & Great Western as a telegraph operator at Sherman, Ohio, and on the New York, Pennsylvania & Ohio as telegraph operator at Akron, Ohio, and later as city agent of the Valley Railway. Mr. Furry moved to Chicago in April, 1894, when he organized the Ohio Injector Company of Illinois, with which company he had since been actively engaged and was its president at the time of his death.

F. W. Furry

M. F. Covert, assistant master car builder of Swift & Co., Chicago, has been appointed sales manager of the Chicago and northwest territory of the Standard Car Construction Company, with office in the Peoples Gas building, at Chicago.

F. O. Bunnell, chief engineer of the Southern Wheel Company, St. Louis, Mo., and formerly engineer of tests on the Chicago, Rock Island & Pacific, has been elected vice-president of the Southern Wheel Company, with headquarters at St. Louis.

The Locomotive Pulverized Fuel Company, New York, has received an order from Morris & Company, packers, for the installation of complete apparatus for pulverizing, distributing and burning powdered coal in the company's plant at Oklahoma City, Okla.

J. M. Hopkins, chairman of the board of the Camel Company, Chicago, has been appointed a member of the priorities committee of the War Industries Board. Mr. Hopkins will handle export matters except those for Japan and for the allied governments having war missions.

M. V. Bailliere, formerly mechanical engineer of the New York Central lines west of Buffalo, with headquarters at Cleveland, Ohio, has become associated with the Roberts & Schaefer Company, at Chicago, as contracting engineer, succeeding Clyde C. Ross, who has been promoted to contracting manager. In his new position, Mr. Bailliere will be engaged in the designing, contracting and erection of locomotive coaling plants, "R and S" gravity sand plants and cinder handling plants. He is a graduate of the mechanical engineering school of Cornell University. After completing his work at Cornell he went to the Helena Power Transmission Company at Butte, Mont., where he remained for approximately a year and a half, following which he entered the service of the New York Central as a draftsman in the engineering department at Cleveland, Ohio. Subsequently he became assistant engineer and mechanical engineer, resigning from the latter position to go to the Roberts & Schaefer Company, as mentioned above.

M. V. Bailliere

The T. H. Symington Company, Rochester, N. Y., has closed its Chicago and Baltimore offices for the period of the war. All inquiries and correspondence from the Chicago territory will be handled by the Rochester office and from the Baltimore territory by the New York office.

Lloyd H. Atkinson has resigned as vice-president of the Air Reduction Sales Company, Inc., 120 Broadway, New York. Mr. Atkinson has been in poor health for some time, as a result of overwork, and will take an extended vacation before engaging in one of the war service activities.

A. M. Brown, assistant manager of the compressor sales division of the Chicago Pneumatic Tool Company at New York, has been appointed district manager of sales, with office at Philadelphia, Pa., succeeding G. A. Barden, who will remain in Philadelphia as sales representative for the company.

Paul G. Cheatham, sales representative of the Baldwin Locomotive Works and the Standard Steel Works at St. Louis, Mo., has been transferred to the Chicago office, succeeding A. S. Goble, now southwestern district representative, with headquarters at St. Louis, Mo. Mr. Cheatham's transfer was effective October 1.

The Chicago Railway Supplies Liberty Loan Committee, of which Charles K. Knickerbocker, vice-president

of the Griffin Wheel Company, was chairman, secured subscriptions from railway supply companies amounting to $6,875,000, which was greatly in excess of the quota of $5,270,000 assigned to the committee.

Frank H. Brown has been appointed sales manager of the Sherritt & Stoer Company, Inc., Philadelphia, Pa., and assumed his new duties October 7. Mr. Brown was one of the founders of the Brown & Zortman Machinery Company, Pittsburgh, Pa., and has been associated more recently with the Davis Machine Tool Company of Rochester, N. Y.

H. E. Chilcoat, who was recently made manager of the Clark Car Company, manufacturers of the Clark extension side dump car, was born in Orbisonia, Pa., and received his early education in the public schools at that place. In 1900 he went to the Pittsburgh district, entering the employ of the Pennsylvania Railroad as machinist helper and served successively as work inspector, gang foreman and foreman of the air brake department until 1906, when he left the railroad company to enter the service of the Westinghouse Air Brake Company as traveling inspector. Shortly after joining the Westinghouse organization he was assigned to the Southeastern district with headquarters at Richmond, Va. In 1910, he was transferred to the Pittsburgh district office as representative, looking after the commercial interests of the company in the district served by that office until August, when he resigned to take up the duties of his present position, with headquarters at Pittsburgh, Pa.

H. E. Chilcoat

Lauren J. Drake, president of the Standard Oil Company of Indiana, died at his home in Chicago on October 10. Mr. Drake was born at Buffalo, N. Y., on January 29, 1846. For years he was a director of the Standard Oil Company of New Jersey, vice-president and director of the Galena Signal Oil Company and active in other Standard oil properties.

John R. Edmonds, traveling representative of the Schroeder Headlight & Generator Company, Evansville, Ind., has entered the Engineers (Ry.), U. S. Army, at Ft. Benjamin Harrison, Indianapolis, Ind. Mr. Edmonds is attached to an operating railway regiment which is being organized to assist in the operation of the U. S. Military Railways in France.

A. G. Lapierre, until recently assistant in the Northwestern regional director's office, has been appointed traffic manager of the Chicago Pneumatic Tool Company, with headquarters at Chicago, succeeding E. H. Greene, resigned. F. O. Southbrook, efficiency man with Joseph T. Ryerson & Sons, Chicago, has been appointed manager of the order and production department of the same company, with headquarters at Chicago.

At a meeting of directors of the Safety Car Heating & Lighting Company, the vacancy caused by the death of Robert M. Dixon, president of the company, was not filled, but W. L. Conwell, vice-president, was appointed executive officer of the company with full powers of the president. At a meeting of directors of the Pintsch Compressing Company, J. A. Dixon, vice-president, was appointed executive officer with full powers of the president.

Charles E. Goodnow, formerly assistant sales manager of the electrical and special wire department of the American Steel & Wire Company, and more recently identified with building construction work in Washington and Brooklyn for the army and navy, is now with the Page Steel & Wire Company, 30 Church street, New York. Mr. Goodnow's efforts will be devoted to sales and service work for Armco iron welding rods and "Copperclad" electrical wire.

The Walter A. Zelnicker Supply Company, St. Louis, Mo., announces the appointment of R. H. Wilson as assistant to the president, with office at St. Louis. Mr. Wilson, who has been with the company for years, latterly as Houston, Texas, representative, is succeeded there by E. O. Griffin, formerly storekeeper and assistant general manager of the International & Great Northern and more recently assistant to the president of the St. Louis Southwestern in charge of purchases.

W. W. Coleman, president of the Bucyrus Company, South Milwaukee, Wis., and T. H. Symington, president of the T. H. Symington Company, Rochester, N. Y., have both been appointed special representatives to the chief of ordnance, with office at Washington. Mr. Coleman will be in charge of all matters relative to the production of cannon, carriages and their equipment, appurtenances and accessories. Mr. Symington will have charge of artillery ammunition, metal components.

The Chicago Pneumatic Tool Company is contemplating the construction of a reinforced concrete plant in Detroit, Mich., which will be five stories in height, with a finished basement, and will cost between $200,000 and $250,000. The structure will be 180 ft. by 60 ft. The company also will build a 45 ft. by 150 ft. extension to the erecting department at its No. 2 plant at Franklin, Pa. The building will be of brick and steel construction, and will cost about $30,000. Bids are now being received on these buildings.

Lieut.-Col. Robert Patterson Lamont, president of the American Steel Foundries, who has been assistant chief in the procurement division of the ordnance department of the army, has been promoted to succeed Brig.-Gen. Samuel McRoberts as division chief of ordnance, with headquarters at Washington, D. C. His military rank, however, continues the same. Col. Lamont was born at Detroit, Mich., on December 1, 1867, and graduated from the University of Michigan in 1891. After leaving college he was engaged as engineer of construction at the World's Columbian Exposition in Chicago, and from 1892 to 1897, was secretary and engineer of the contracting firm, Shailer & Schinglau. He then became connected with the Simplex Railway Appliance Company as first vice-president. In 1905, he was elected first vice-president of the American Steel Foundries, and was elected president in 1911.

Lieut.-Col. R. P. Lamont

Phillips Wesley has been appointed manager in charge of the oxyhydrogen plant and sales office of the International Oxygen Company at Pittsburgh, Pa. The company announces also that Jack Heller, long with L. Heller & Sons, has joined its New York sales force, succeeding Mr. Barnitz.

George Quelch, one of the staff engineers of the International Oxygen Company, 115 Broadway, New York, sailed recently for England to supervise the installation of a 480-cell plant of unit oxyhydrogen generators for the British admiralty.

John P. Hopkins, chairman of the board of directors of the Independent Pneumatic Tool Company, and former mayor of Chicago, died in that city on Sunday, October 13. He was ill only a few days and death was attributed to a weak heart superinduced by an attack of Spanish influenza. Mr. Hopkins was born in Buffalo, New York, in 1858. He moved to Chicago in 1880 and accepted a position with the Pullman Palace Car Company as a machinist. Later he went into business for himself as a partner in the firm of Secord & Hopkins, general merchandise, at Pullman, Ill. This venture proved successful and was the foundation for a large fortune. Mr. Hopkins was a national figure in politics. He served the unexpired term of Carter H. Harrison, Sr., as mayor of Chicago in 1893-94, and was several times chairman of the Democratic National Committee. Since the beginning of the war he has served as secretary of the Illinois Council of Defense. In 1905 he became interested in the Independent Pneumatic Tool Company and was the largest stockholder. He was one of the original organizers of this company and was chairman of the board of directors at the time of his death.

Robert M. Dixon, president of the Safety Car Heating & Lighting Company, and of the Pintsch Compressing Company, New York, died at his home in East Orange, N. J., October 16, of heart disease. Mr. Dixon had been associated with the Safety Car Heating & Lighting Company or one of its predecessors since 1883. He was born September 19, 1860, at East Orange, N. J., in the house where he lived at the time of his death. He was educated in the public schools and graduated from Stevens Institute of Technology in the class of 1881 with the degree of mechanical engineer. For two years he was employed with the Delaware Bridge Company, of Trenton, N. J., leaving that company in March, 1883, to become assistant engineer of the Pintsch Lighting Company, which was merged with the Safety Car Heating & Lighting Company in 1887, with Mr. Dixon as chief engineer. He was elected vice-president of the company on January 15, 1902, and became its president in May, 1907, which office he held at the time of his death. Mr. Dixon spent the greater part of his life in the field of railway car heating and lighting, being identified with the first application of steam from the locomotive for heating railway passenger cars and with the development of gas and electricity for lighting railway cars. He was also active in the field of harbor and coast lighting. Mr. Dixon was a member of the American Society of Mechanical Engineers for 35 years. He was a trustee and a member of the finance committee of the United Engineering Societies from 1917 until the time of his death. He was also active as an executive officer of the New York Railroad Club from its early days. He served as treasurer since 1903, prior to which he was chairman of the financial committee. He was a member of the executive committee of the club for 35 years.

R. M. Dixon

CATALOGUES

Pulverized Fuel.—The Locomotive Pulverized Fuel Company, New York, in bulletin No. 6 describes results obtained from burning coal under stationary boilers with the "Lopulco" pulverized fuel system.

Pneumatic and Electric Tools.—The Independent Pneumatic Tool Company, Chicago, has recently issued circular No. 27 illustrating and describing in convenient tabular form the line of Thor pneumatic and electric tools which the company manufactures. These include the Thor cylinder and turbine air drills, electric drills, pneumatic hammers, pneumatic holder-ons and pneumatic sand rammers.

Welding and Cutting Apparatus.—The Bastian-Blessing Company, Chicago, has issued a 26-page catalogue illustrating complete units of Rego welding and cutting apparatus, and giving complete descriptions of the cutting and welding torch details and the Rego diaphragm regulator details. The company's line of oxygen, acetylene and hydrogen welding regulators and adapters is also illustrated.

Battery Charging Equipment.—The Cutler-Hammer Manufacturing Company, Milwaukee, Wis., has recently issued a four-page, illustrated pamphlet describing the C-H sectional battery charging equipment for electric vehicles and industrial trucks. Some of the distinctive points claimed for this kind of equipment are the adoption of a standard unit as the basis for forming panels and groups of panels, and the ability to make future equipment conform and be an addition to present equipment.

Threading Machinery.—An attractive 78-page catalogue, No. 24, has been issued by the Landis Machine Company, Waynesboro, Pa., which is devoted almost entirely to a detailed description of Landis bolt threading and screw cutting machinery, but also briefly describes the Landis pipe and nipple threading machine and the Landis pipe threading and cutting machine. It contains many illustrations of the machines and sketches of the detail parts, as well as a table of U. S. standard, V, Whitworth and International threads and a table showing cutting speeds per revolution of head per minute.

Horizontal Boring Machine.—A detailed description of the Landis No. 35 floor type horizontal boring, milling and drilling machine, illustrated with numerous photographs of the assembled machine and its parts, is contained in a 15-page catalogue issued by the Landis Machine Company, Waynesboro, Pa. This machine has an almost universal range of adaptability and may be used to bore, mill, drill, tap, spline, oilgroove, or rotary-plane at one setting and when a swiveling table is used, the work can be finished on all sides without resetting. The catalogue also contains a sketch showing a sectional view of the spindle driving and feeding mechanism, with all of the details numbered.

Pipe Corrosion.—A paper entitled The Preservation of Hot Water Supply Pipe in Theory and Practice, presented by F. N. Speller and R. G. Knowlands at the annual meeting of the American Society of Heating and Ventilating Engineers and published in the journal of that society, has been reprinted in a 24-page booklet by the National Tube Company, Pittsburgh, Pa. This is a treatise on the subject of pipe corrosion and of the factors controlling it, and the broad, simple principles applying to every case of corrosion are briefly discussed with particular reference to hot water supply systems. The discussion of the paper at the meeting is included, and the text is illustrated with several sketches and photographs.